THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. 64 JULY, 1950 No. 1

ALVEOLAR CELL TUMORS OF THE LUNG*

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ALVEOLAR cell tumor of the lung is a rare neoplasm which has attracted a great deal of interest in recent years because of its apparent multicentric origin from the cells lining the pulmonary alveoli and because of its apparent morphologic similarity to a disease of sheep known as "jagziekte"[2,3] or "Montana progressive pneumonia." Most of the 52 cases which have been reported in the literature[6] have been observed at necropsy, there being only 3 instances[4,5,13] in which surgical procedures were employed in treatment. Since February, 1943, we have observed 8 patients who were found to have alveolar cell tumor of the lung and who were treated surgically by some type of pulmonary resection. A search of our files has disclosed 4 additional cases which were encountered at necropsy. We are reporting these 12 cases in detail.

REPORT OF CASES

CASE 1. A white woman, aged fifty-four, was first seen on February 2, 1943. For one year she had experienced a severe nonproductive cough. During this period she had lost 12 pounds (about 5 kg.). Her husband was known to have died of pulmonary tuberculosis.

Physical examination disclosed dullness to percussion and coarse rales in the basal portion of the left side of the thorax posteriorly. A roentgenogram of the thorax showed an area of consolidation in the left lower lobe (Fig. 1*a*) which was thought by the roentgenologist to represent a pulmonary abscess or an area of bronchiectasis. A bronchogram (Fig. 1*b*) showed incomplete filling of the lower lobe bronchus. The sputum was examined for the presence of tubercle bacilli, which were not found even after inoculation into guinea pigs. It was not examined cytologically for the presence of cancer cells. The blood sedimentation rate was 32 mm. per hour (Westergren). Nothing of significance was found by bronchoscopic examination. Although it was the impression of the clinical consultant that the lesion in the lung was inflammatory, an exploratory thoracotomy was recommended because of the fact that the existence of a neoplasm could not be excluded.

Left lower lobectomy was performed. At the time of operation no evidence of metastasis was found in the left side of the thorax. The entire left lower lobe was replaced by a pinkish mass

* Presented at the Fiftieth Annual Meeting, American Roentgen Ray Society, Cincinnati, Ohio, Oct. 4–7, 1949.

which on cut surface was composed of nodules tending to be confluent. The pleura was not involved. The cut surface of the tumor was glistening. Histopathologically the picture was that of a typical alveolar cell tumor with the cells showing only moderate degree of irregularity (grade 2, on the basis of 1 to 4, in which 1 designates the mildest and 4 the most severe

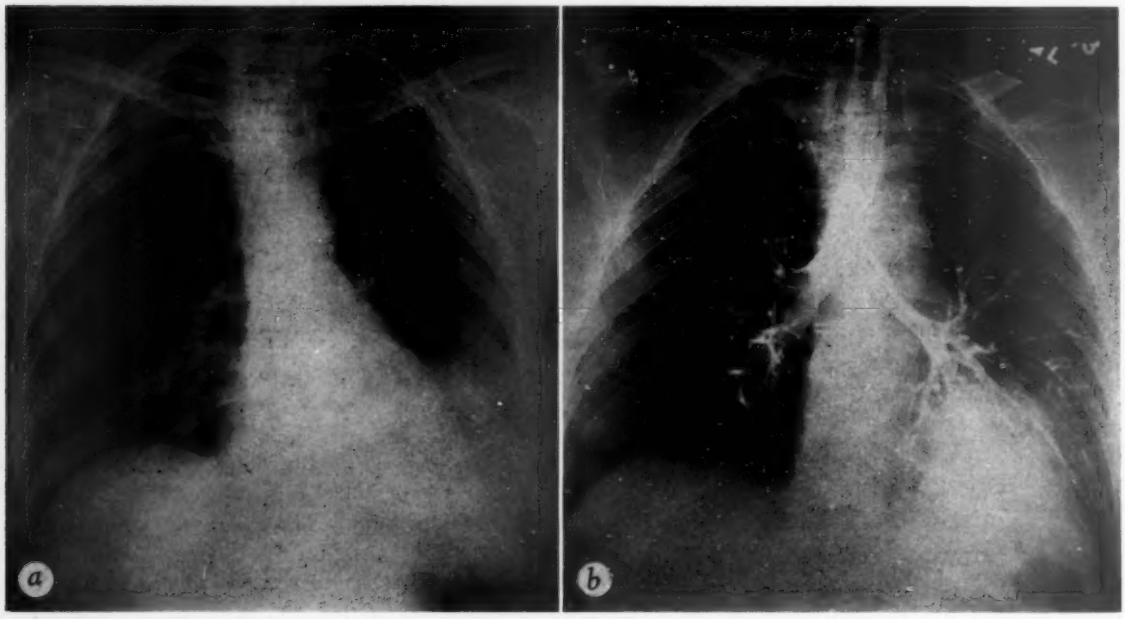

FIG. 1. Case 1. *a*. Alveolar cell tumor involving left lower lobe. *b*. Bronchogram from same case. There appears to be bronchiectasis and incomplete filling of the lower lobe bronchus. Nothing can be seen which is specific for a diagnosis of alveolar cell tumor.

condition). There were numerous clear cells which revealed the presence of mucus. The mucus was present also in the adjacent non-neoplastic alveoli. Some fat was present in the interalveolar septa but there was none in the tumor cells. Numerous lipophages were seen in the neoplastic, as well as the non-neoplastic, alveoli. A reticulum stain showed that the alveolar septa were intact in the region of the tumor.

The patient died of a myocardial infarct on the fifth postoperative day, and necropsy revealed that no tumor was present in the other lobes of the left lung or in the right lung. There was no evidence of distant metastasis.

CASE II. A woman, aged thirty-four, was first seen on October 7, 1946. She had experienced recurrent attacks of pain low in the back for three or four years. When she was fourteen years of age a swelling was present in the cervical region but this had disappeared after a short period. Four months before she was seen at the Mayo Clinic this swelling had recurred in the right cervical region. Her physician had removed a cervical lymph node and told her that the pathologist had reported hyperplastic lymphadenitis. For seven months prior to her first visit to the clinic she had suffered from a chronic cough which was productive of a small amount of whitish clear sputum. A fever of low grade had been present intermittently.

Nothing of significance was found at the time of physical examination. A roentgenogram of the thorax revealed an unsuspected lesion in the left lung posterior to the hilus (Fig. 2). This was described as a poorly circumscribed area of pneumonitis. It was thought by the roentgenologist to represent an inflammatory lesion and a diagnosis of tuberculosis was suggested. The blood sedimentation rate was 69 mm. per hour (Westergren). Nothing of importance was found by bronchoscopic examination. Cytologic examination of the sputum and bronchial secretions was not done. Examination of the sputum for tubercle bacilli, including injection into guinea pigs, gave negative results. Because a definite diagnosis could not be made an explora-

tory thoracotomy was recommended.

Left lower lobectomy was performed. At the time of operation no evidence of metastasis was noted in the left side of the thorax. The entire left lower lobe was voluminous, solid and airless. The cut surface was pinkish and appeared to have the consistency of liver. The tumor was composed of nodules which tended to become confluent. The pleura on the anterior surface of the lobe was puckered but otherwise was uninvolved. Histologically the alveolar septa were lined by cells having pinkish cytoplasm which in places was clear. The cells formed papillae which extended into the alveoli. A reticulum stain revealed that the alveolar septa were intact. There was fat in the interalveolar septa but none in the tumor cells. The tumor cells showed fairly large nuclei with considerable variation in size (grade 3). Mucicarmine stain was positive in some areas.

Four months after operation lymphadenopathy developed in the cervical and axillary regions. A biopsy from one of the enlarged nodes showed the lesion to be Hodgkin's disease. The patient was given roentgen therapy but died two years after her operation. A necropsy was not performed.

Case III. A white woman, aged sixty-two, was first seen on May 29, 1947. She complained of a nonproductive cough which had been present for six months.

On physical examination the breath sounds were found to be diminished over the base of the left lung. A roentgenogram of the thorax showed a reaction of the pleura in the region of the left side of the diaphragm and a large area of consolidation in the left lower lobe (Fig. 3*a*). The roentgenologist suggested the possibility of the lesion being a carcinoma. The blood sedimentation rate was 14 mm. per hour (Westergren). A bronchoscopic examination disclosed an infiltrative lesion in the medial branch of the bronchus to the left lower lobe, which bled easily. Tissue obtained by biopsy from this site showed no evidence of malignancy but bronchial secretions obtained at the same time from the left lower lobe showed carcinoma cells to be present. Pulmonary resection was recommended.

Left lower lobectomy was performed. At the time of operation no evidence of metastasis was found in the left side of the thorax nor was there any evidence of spread of the lesion to the other lobe of the left lung. The entire left lower lobe

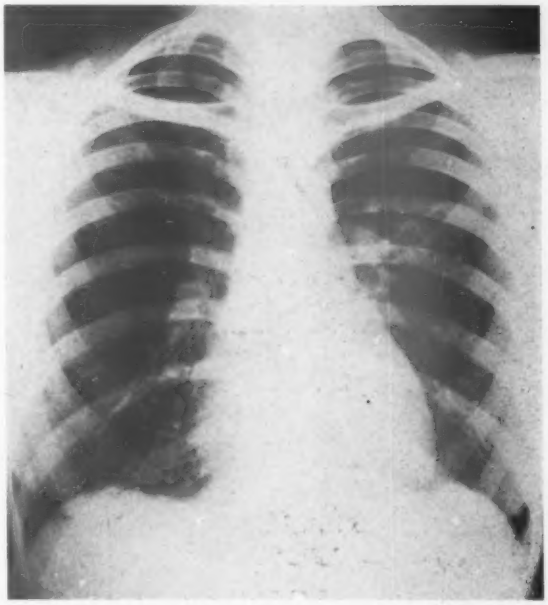

Fig. 2. Case II. Alveolar cell tumor causing a small, poorly circumscribed shadow in the apex of the left lower lobe.

was replaced by a pinkish white tumor which contained a cavity 5 cm. in diameter filled with bloody fluid. Along the base of the lobe the tumor was nodular. There was no involvement of the pleura. Microscopically the pulmonary alveoli were lined by columnar cells which formed papillary projections. The cytoplasm of these cells stained pink. The nuclei of these cells were quite irregular, and because of this the tumor was called grade 3. A mucicarmine stain was slightly positive. A reticulum stain demonstrated that the alveolar septa were intact between the tumor cells.

Two years after operation the patient was living and well, except that she still complained of the pain low in the back which she had experienced for many years.

Case IV. A white woman, aged forty-seven, was first seen on September 7, 1948. Four years before admission she had suffered from an attack of bronchitis. Two years before she was seen she suffered from a recurrence of this bronchitis, which was accompanied by a severe productive cough which lasted for three weeks. At that time the sputum was bloody on one occasion. Penicillin was administered, which relieved her symptoms. Seven months before she was first seen a chronic cough had developed which was productive of a watery, clear spu-

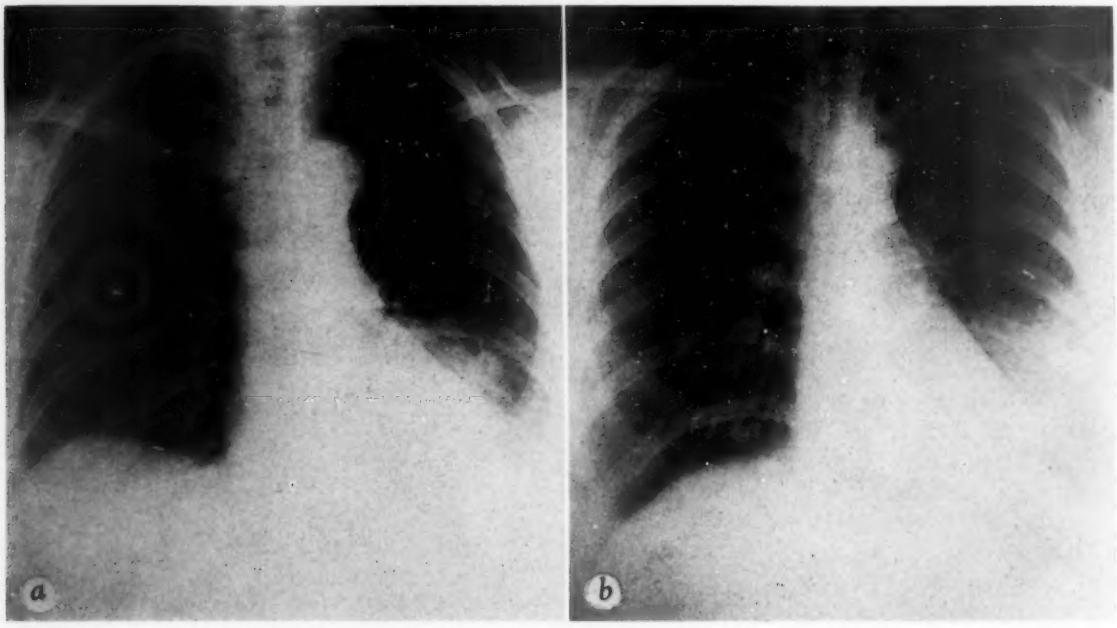

FIG. 3. *a*. Case III. Alveolar cell tumor involving the left lower lobe. *b*. Case IV. Note similarity to Case III. The roentgenologic appearance is similar to that of pneumonia, bronchogenic carcinoma and several other pulmonary diseases.

tum. Occasionally the sputum was blood tinged. Coughing produced a feeling of discomfort beneath the sternum. Her physician had been unable to find tubercle bacilli in her sputum.

Physical examination on admission revealed a few coarse rales and some dullness to percussion in the base of the left side of the thorax. A roentgenogram of the thorax showed an area of pneumonitis in the left lower lobe (Fig. 3*b*) which was thought by the roentgenologist to represent an inflammatory lesion. The blood sedimentation rate was 18 mm. per hour (Westergren). Cytologic examination of the sputum was reported to show no malignant cells. When this material was reviewed after the results of the operation were known, tumor cells were found to be present. Nothing of significance was found by bronchoscopic examination. A clinical diagnosis of chronic pneumonitis of the left lower lobe was made and thoracotomy was recommended.

Left lower lobectomy was performed. At the time of operation there was no evidence of metastasis in the left side of the thorax, nor was there involvement of the other lobe of the left lung; the inferior four-fifths of the left lower lobe was solidified and airless and was replaced by a whitish pink tumor mass. The remainder of the lobe contained scattered nodules of the tumor. These nodules averaged about 0.5 cm. in diameter. There was no involvement of the pleura. On microscopic examination the pulmonary alveoli were found to be lined by cells characteristic of alveolar cell tumor. The cells showed very little irregularity, and for this reason the tumor was called grade 2. A mucicarmine stain was negative. A reticulum stain showed that the interalveolar septa were intact in the areas of the tumor.

Contact with this patient has been lost, and we do not know if she is alive at the present time.

CASE V. A white man, aged fifty-three, was first seen on September 21, 1948. For eighteen months he had suffered from a cough which was productive of frothy white sputum. The sputum had contained blood on one occasion. Two weeks prior to admission a roentgenogram of the thorax was said to show collapse of the entire right lung.

Physical examination on admission showed the breath sounds to be absent over the right side of the thorax, and a few coarse rales were heard. Three examinations of the sputum failed to reveal any evidence of malignant cells. Serologic reactions of the blood for syphilis were positive. A roentgenogram of the thorax showed a dense hemispherical mass on the right side (Fig. 4*a*); the broadest portion of the mass

was directed toward the posterior thoracic wall. Numerous nodules were seen in the rest of the right lung. The roentgenologic diagnosis was carcinoma of the lung with metastasis in the lung. Nothing of significance was seen at the time of bronchoscopic examination. Because a definite diagnosis could not be made, exploratory thoracotomy was recommended.

Right pneumonectomy was done. The lymph nodes at the hilus were found not to be involved by tumor. Grossly the right middle lobe was airless, voluminous and completely replaced by a pinkish tumor mass which on cut surface appeared to be mucoid in character. The right upper and lower lobes were not so diffusely involved as the right middle lobe but contained many nodules of tumor. These nodules measured from 0.5 cm. to 1 cm. in diameter. The mucoid appearance of these lobes was similar to that seen in the middle lobe. Microscopic examination showed that the pulmonary alveoli in the areas of tumor were lined by columnar cells having voluminous cytoplasm and small nuclei. There was very little irregularity of the nuclei and as a result this tumor was called grade 1. A most marked feature was the production of mucus by the cells. Not only was this evident in the regions of tumor but also in the adjacent uninvolved pulmonary alveoli. The alveolar septa were not thickened and were easily demonstrated by a reticulum stain. Many lipophages were present in the involved, as well as the uninvolved, alveoli. All parts of the tumor showed similar structure.

Seven months after operation the patient returned for observation. A roentgenogram of the thorax (Fig. 4*b*) showed a lesion to be present in the left lung. It is believed that this represents a recurrence of the alveolar cell tumor.

Case vi. A white woman, aged thirty, was first seen on September 27, 1948. For twelve months she had suffered from a chronic cough which was productive of a gray, mucoid type of sputum. Occasionally the sputum was blood streaked. Tuberculosis was suspected and she was placed in a sanatorium, where the diagnosis of tuberculosis could not be confirmed. While there, she was found to have a fever each afternoon. During this time she lost 19 pounds (about 9 kg.).

Physical examination on admission showed rales to be present in both lungs. Cytologic examination of the sputum revealed cancer cells, which were reported as probably being of the alveolar cell type. The blood sedimentation rate was 37 mm. per hour (Westergren). A roentgenogram of the thorax showed a dense, irregular mass in the left lower lobe and a smaller irregular-appearing patchy lesion in the right upper lobe opposite the hilus (Fig. 5*a*). The roentgenologist suspected that the lesion

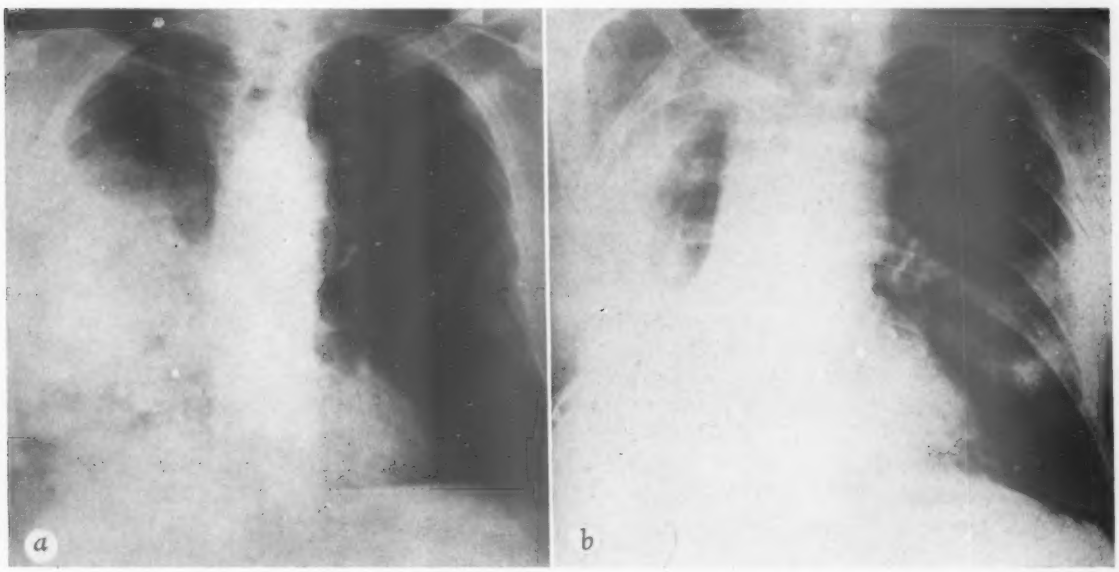

Fig. 4. Case v. *a*. Alveolar cell tumor involving all three lobes of the right lung. In the upper and middle lobes the tumor tends to be diffuse in character, while in the lower lobe it is more nodular. *b*. The same case seven months after right pneumonectomy. Lesions are now apparent in the left lung.

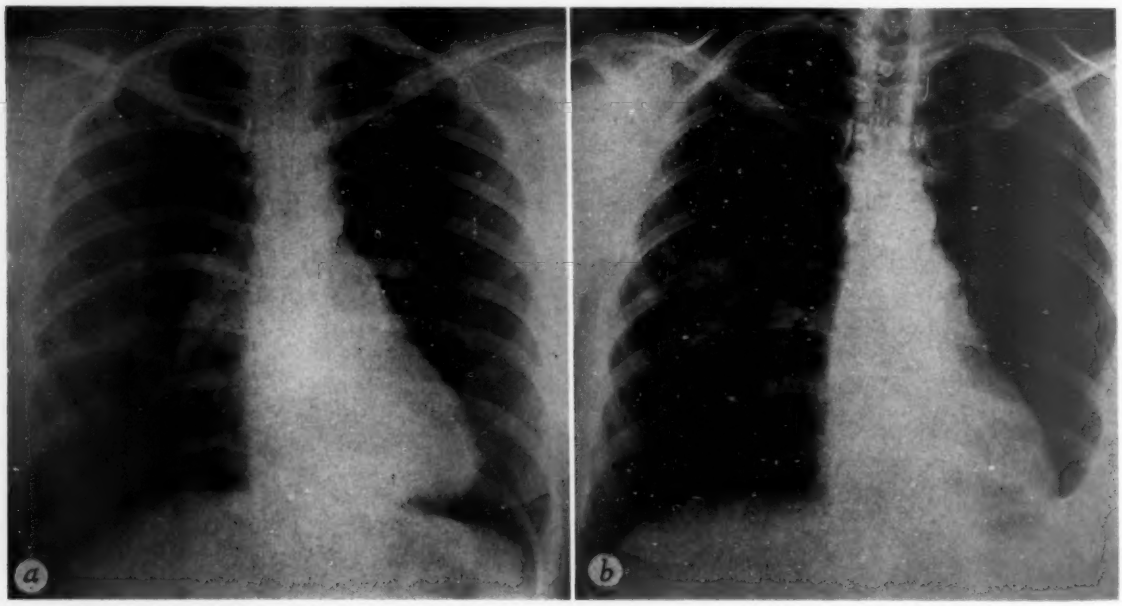

FIG. 5. Case VI. *a*. Bilateral involvement of alveolar cell tumor. There is a fairly well-circumscribed mass in the left lower lobe partly hidden by the shadow of the heart. Patches of tumor can be seen in the midportion of the right lung. *b*. The same case after left lower lobectomy had been performed. The lesion can still be seen in the right lung.

in the left lower lobe was a neoplasm, but he was not certain whether the lesion on the right represented an inflammatory or a neoplastic condition. Nothing of significance was seen at the time of bronchoscopic examination, but washings obtained from the bronchial tree were reported to show carcinoma cells. A specimen for biopsy taken from the left lower lobe bronchus was reported to show alveolar cell tumor.

Because of the nature of the neoplasm it was decided to do a segmental resection of the involved lobes on both sides. Left lower lobectomy was done first. After this operation a roentgenogram (Fig. 5*b*) showed the lesion in the right lung. Two months after the left lower lobectomy, right upper lobectomy, together with a segmental resection of a portion of the right lower lobe, was performed. Grossly the inferior two-thirds of the left lower lobe was replaced by a pinkish white, airless mass. The remainder of the left lung appeared to be normal at the time of operation. The pleura was uninvolved. The right upper lobe was also partially replaced by a pinkish tumor which tended to be distributed in nodules. These nodules ranged from 0.5 cm. to 1 cm. in diameter. There was some puckering of the pleura of the right upper lobe but it was otherwise uninvolved. Microscopically the tumor in the different lobes presented a similar histopathologic appearance. The cytoplasm of the cells stained pink and the nuclei were fairly regular (grade 2). The tumor cells were thrown into papillary folds. The interalveolar septa were intact as demonstrated by the reticulum stain. Mucicarmine stain showed a moderate amount of mucus.

The patient died on the sixth day after the second operation. The cause of death was failure of the right side of the heart. Necropsy was performed and showed that there was no tumor in the remaining lobes of the lungs and that no metastasis was present elsewhere in the body.

CASE VII. A white woman, aged fifty-five, was first seen on December 14, 1948. She gave a history of nonproductive cough and dyspnea, both of which had been present for two years. She told of having experienced several bouts of chills and fever. Ten days prior to admission her sputum contained blood.

Nothing of significance was found at the time of physical examination. The blood sedimentation rate was 46 mm. per hour (Westergren). Cytologic examination of the sputum showed carcinoma cells to be present. The pathologist believed that they were of the alveolar cell type. A roentgenogram of the thorax showed an

area of chronic pneumonitis in the lingular division of the left upper lobe (Fig. 6*a* and *b*). Nothing of significance was seen at the time of the bronchoscopic examination. The clinical diagnosis was alveolar cell tumor of the left upper lobe.

Left upper lobectomy was performed. At the time of operation no nodules were found in the left lower lobe, nor was there evidence of metastasis to the nodes in the hilus. Gross examination showed the lingula of the upper lobe to be involved by a pinkish white tumor which on cut surface appeared nodular. There was no pleural involvement. Microscopic examination revealed typical alveolar cell tumor with moderate irregularity of the nuclei (grade 2). The mucicarmine stain was slightly positive. A reticulum stain showed the interalveolar septa between the tumor cells to be intact.

Six months after operation the patient was living and well. She had experienced complete relief of her very troublesome cough.

Case VIII. A white man, aged forty-nine, was first seen on July 8, 1949. He complained of a chronic cough which was productive of yellow sputum to the extent of half a cup a day. The cough had been present for four months. During this period he had suffered from a fever, which was relieved by the administration of penicillin. He complained also of anorexia, fatigue and dyspnea on exertion. He had lost 12 pounds (about 5 kg.).

Physical examination showed dullness to percussion in the base of the left side of the thorax. The blood sedimentation rate was 40 mm. per hour (Westergren). A roentgenogram of the thorax showed an elevation of the left side of the diaphragm, evidence of fluid in the right pleural space and a poorly circumscribed mass in the superior portion of the right lower lobe (Fig. 7*a*). After further roentgenographic studies and roentgenoscopy a diagnosis was made of possible neoplasm of the right lung with pleural involvement and fluid in the right pleural space. Nothing of significance was found at the time of bronchoscopic examination. Cytologic examination of the sputum revealed the presence of carcinoma cells.

Because of the clinical diagnosis of carcinoma of the right lower lobe pneumonectomy was recommended and performed. In the upper portion of the right lower lobe was found a tumor 3 cm. in diameter, the cut surface of which was pink. There was no evidence of involvement of a bronchus. There were no other nodules in the remainder of the lung. The nodes in the hilus were not involved, nor was the

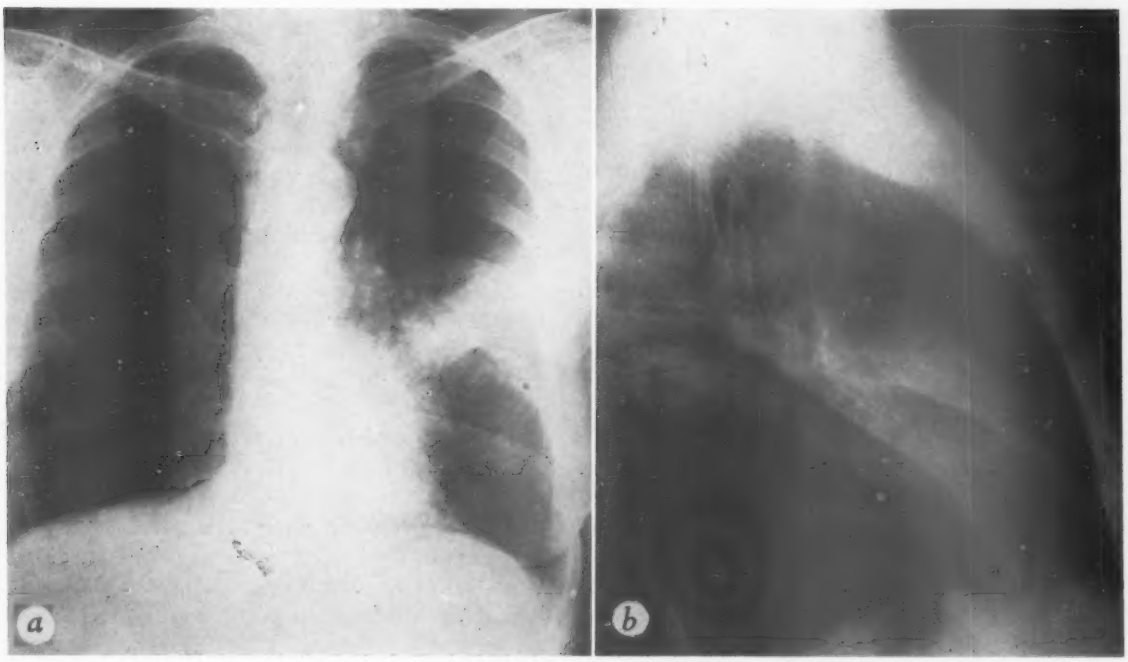

Fig. 6. Case VII. *a*. The left upper lobe is involved by alveolar cell tumor. *b*. Lateral roentgenogram in same case demonstrating involvement of the left upper lobe.

pleura. Microscopically the lesion appeared to be a typical alveolar cell tumor with moderately irregular cells and nuclei (grade 2). A reticulum stain showed the alveolar septa between the tumor cells to be intact. A mucicarmine stain showed a moderate amount of mucus.

The patient's convalescence was uneventful, but too little time has elapsed since the operation to enable one to draw conclusions concerning the outcome.

CASE IX. A white man, aged fifty-seven, was first seen on July 4, 1914. He stated that for six months he had experienced dyspnea and weakness after exertion. He coughed occasionally but raised no sputum.

Physical examination showed the presence of rales and wheezes in the right lung, and the patient was obviously very dyspneic. Serologic reactions of the blood for syphilis were positive. A roentgenogram of the thorax was reported to show "general diffuse tuberculosis in both lungs." This roentgenogram is not available for study at the present time.

The patient died two months after he was first seen and a necropsy was performed. Many tumor nodules were present in both lungs. These nodules tended to become confluent, and the lungs were voluminous and relatively airless. The pleura was not involved. Microscopically the cells were typical of alveolar cell tumor. The cells lining the alveoli were thrown into papillary folds, and the alveolar septa were intact as shown by a reticulum stain. The cytoplasm of the tumor cells stained pink. The nuclei were moderately irregular and the tumor was called grade 3. The mucicarmine stain was negative. No evidence of metastasis was found elsewhere in the body.

CASE X. A white woman, aged forty-four, was first seen on July 9, 1931. For six months she had suffered from a cough which was productive of a watery, sometimes yellow, and usually foul sputum. Dyspnea was present after exertion. On a few occasions the sputum had contained blood.

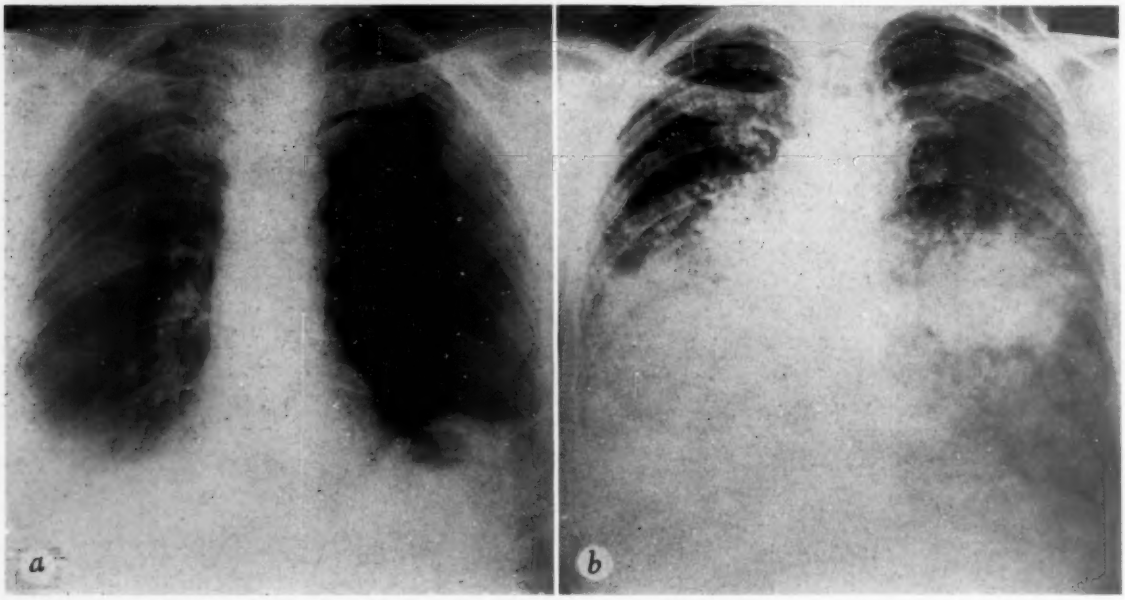

FIG. 7. *a*. Case VIII. Alveolar cell tumor involving the superior segment of the right lower lobe. There is evidence of free fluid in the right pleural space. *b*. Case X. Bilateral alveolar cell tumor. Many nodules can be seen, and a large mass formed of confluent nodules of tumor is apparent in the left lung.

Physical examination revealed an area of dullness over the left side of the thorax. A roentgenogram of the thorax showed a large mass in the region of the left lower lobe, and there were many nodules scattered throughout both lungs (Fig. 7*b*). The lateral division of the left lower lobe bronchus was found to be narrowed at the time of bronchoscopic examination. A biopsy taken from this area showed adenocarcinoma.

A course of roentgen therapy resulted in some

clinical improvement, but the patient gradually became weaker and died five months after registration. At necropsy the left lung was found to be voluminous and diffusely involved by a pinkish tumor which tended to be distributed in nodules. The nodularity of the tumor was more marked in the upper lobe than in the lower lobe. There was no evidence of involvement of the larger bronchi. Many tumor nodules were present in the right lung, also. Metastatic growths were present in the regional lymph nodes and in the adrenal glands. Histopathologically the tumor was typical of alveolar cell carcinoma. Because of the irregularity of the tumor cells it was called grade 4. The interalveolar septa were intact. No mucus was demonstrated by the mucicarmine stain.

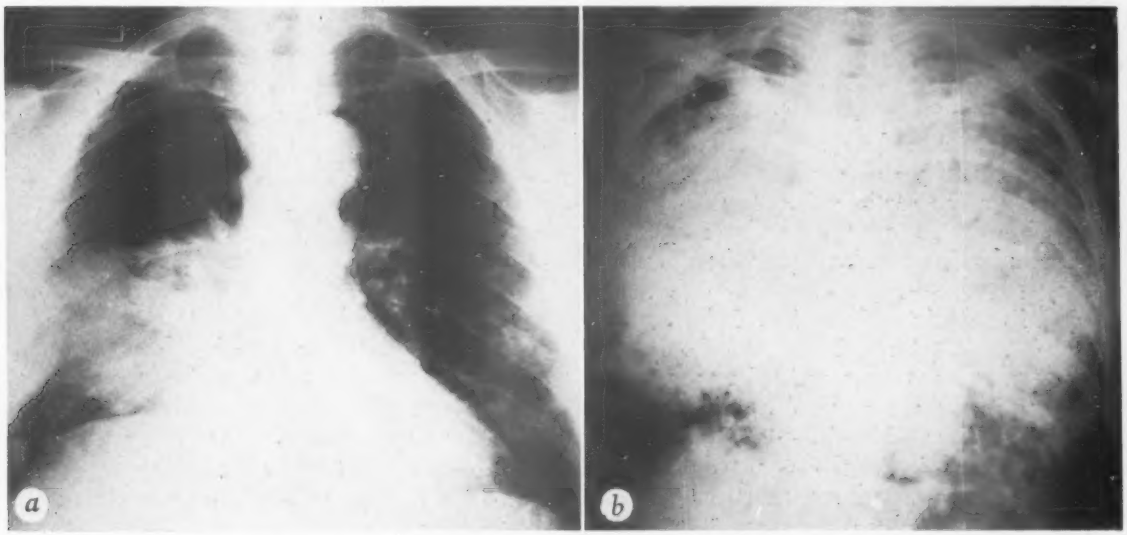

FIG. 8. *a*. Case XI. A large mass of alveolar cell tumor is seen on the right. Less apparent are many small tumor nodules in the left lung. *b*. Case XII. Bilateral diffusely disseminated alveolar cell tumor.

CASE XI. A white man, aged fifty-six, was first seen on August 4, 1941. He complained of a chronic cough which had been present for two years. For the past four months the cough had been productive of sputum in which blood had occasionally been present. For the past three months he had noticed a pain underneath the sternum. This was accentuated by deep breathing. Dyspnea was present after exertion.

At the time of physical examination wheezes were heard in the upper half of the right lung. A roentgenogram of the thorax showed a large, poorly defined mass on the right side (Fig. 8*a*). Scattered throughout the right and left lungs were small nodules. No tumor was seen in the bronchial tree at the time of bronchoscopic examination, but it was found that the posterior wall of the right lower lobe bronchus bulged forward to some extent. Biopsies taken from this region were negative on three separate occasions.

The patient died suddenly ten days after registration. A necropsy was performed and the right lung was found to be almost completely replaced by tumor. The tumor was more diffuse in the middle and lower lobes and more nodular in the upper lobe. The left lung was also found to contain numerous small nodules of tumor. There was no evidence of metastasis to the nodes in either hilus nor to the rest of the body. Microscopic examination showed a typical alveolar cell tumor which was called grade 3. The mucicarmine stain was positive and the reticulum stain showed the interalveolar septa to be intact.

CASE XII. A white man, aged forty-six, was first seen on March 8, 1946. He had suffered from shortness of breath and weakness for three and a half months. Cough which was productive of sputum had been present on several occasions.

At the time of physical examination rales were heard in both lungs, and the patient was markedly cyanotic. A roentgenogram of the thorax showed extensive involvement of both

lungs by a nodular, diffuse lesion which spared only the regions of the apexes and costophrenic angles (Fig. 8*b*). Because the patient was extremely ill and because of the cyanosis he was placed in an oxygen tent and bronchoscopic examination was omitted. He had lost 90 pounds (about 41 kg.). The blood sedimentation rate was 28 mm. per hour (Westergren).

The patient died four days after registration. At necropsy it was found that both lungs were studded with small nodules of tumor. There was metastatic involvement of the lymph nodes in the hilus of each lung and also in the liver. Microscopically the cells were typical of alveolar cell tumor. Because of their irregularity the tumor was called grade 4. The hilar nodes and the liver showed the same type of cells which were present in the tumor in the lung. No mucus was demonstrated by the mucicarmine stain.

COMMENT

It is impossible to draw conclusions regarding the incidence of alveolar cell tumor from such a small series of cases. It is of interest, however, that 7 of these cases were encountered during the time that 275 resections of the lung were performed for neoplasm.*

The majority of case reports of this lesion in the literature have been listed under the following headings, all of which appear to us to be different interpretations of a comparable disease process: pulmonary adenomatosis, alveolar cell tumor and alveolar cell carcinoma. A disease with very similar morphology has been observed in sheep,[2,3] mice,[11] horses[10] and guinea pigs.[7] Whether the condition in animals is a true neoplasm or an infection has not been adequately settled at this time.

There are several conditions found in humans which resemble alveolar cell tumor. Among these is a condition in which the pulmonary alveoli become lined with epithelial cells in response to inflammation.[1] In such a lung the alveolar septa are markedly thickened and inflammatory cells can be demonstrated in the septa. In typical alveolar cell tumor the septa are not thickened, a fact which can be demonstrated easily by a reticulum stain.

Metastatic adenocarcinoma may also be confused with alveolar cell tumor. It is possible for such a tumor, particularly one arising from the intestinal tract or the thyroid, to metastasize to the lung and for the pulmonary alveoli to be lined by tumor cells which closely resemble the cells of alveolar cell tumor. The presence of a demonstrable primary focus is evidence against a diagnosis of alveolar cell tumor.

Peripherally placed bronchogenic carcinomas may also be confused with alveolar cell tumor. In our experience these lesions have usually been adenocarcinomas. In this condition the alveolar septa are not intact.

Certain of the cases of alveolar cell tumor which have been reported in the literature fall into these other categories. It seems unnecessary to review the entire literature on the subject at this time. Excellent reviews have been given by Laipply and Fisher,[8] and by Neubuerger and Geever.[9] Up to the present time we have been able to find reported in the literature 52 cases which answer the criteria of alveolar cell tumor.[6] Of these, 49 cases were observed at necropsy and 3 at the time of surgical procedures on the thorax.[4,5,13]

GROSS PATHOLOGY

The gross pathologic characteristics of the cases that we have observed have been very similar in all instances except for the question of the amount of involvement of pulmonary tissue. The tumor mass has caused that portion of the lung which is involved to be voluminous and airless. This factor, because the accessibility to the hilus is limited by the volume of the tumor, frequently makes surgical resection a difficult procedure. In some instances the tumor mass has tended to be diffuse, in other cases to be nodular with intervening nonneoplastic pulmonary tissue. This tendency to nodularity divides alveolar cell tumors into two groups. In reality, however, it is probable that the diffuse type of alveolar cell tumor is a lesion which was nodular in the beginning but in which the nodules of

* These were included in an exhibit on "Tumors of the Lung" prepared by Drs. J. R. McDonald, L. B. Woolner and A. H. Bulbulian for the meeting of the American Medical Association, June, 1949.

tumor tissue have become confluent. Even in the more diffuse tumors there is a tendency to nodularity.

Six of the 12 cases in this series showed involvement of more than one lobe of a lung (Fig. 9*a*), and 6 showed involvement of one lobe only (Fig. 9*b*). It is to be remembered, however, that the cases which showed involvement of one lobe only were surgical cases, and that it is impossible to prove the absence of disease in the opposite lung in 5 instances. In the sixth case (Case 1) subsequent necropsy proved the lack of further involvement. Of the 6 cases which showed involvement of more than one lobe, 4 were seen at necropsy and 2 were encountered at the time of operation. In 5 cases involvement was bilateral. One of these patients underwent operation. One of the patients on whom pulmonary resection was carried out has at the time of this report what is thought to be a recurrence of the process in the opposite lung (Case v).

The disparity between the amount of involvement of pulmonary tissue in our series of cases and in those reported in the literature is probably explained on the basis that in two-thirds of our cases surgical exploration was performed for what appeared to be localized lesions. It has been our practice for some time to operate upon patients with pulmonary lesions where a definite diagnosis cannot be established before operation. It may be that the disease was encountered at an earlier stage in some of these patients than in those cases reported in the literature.

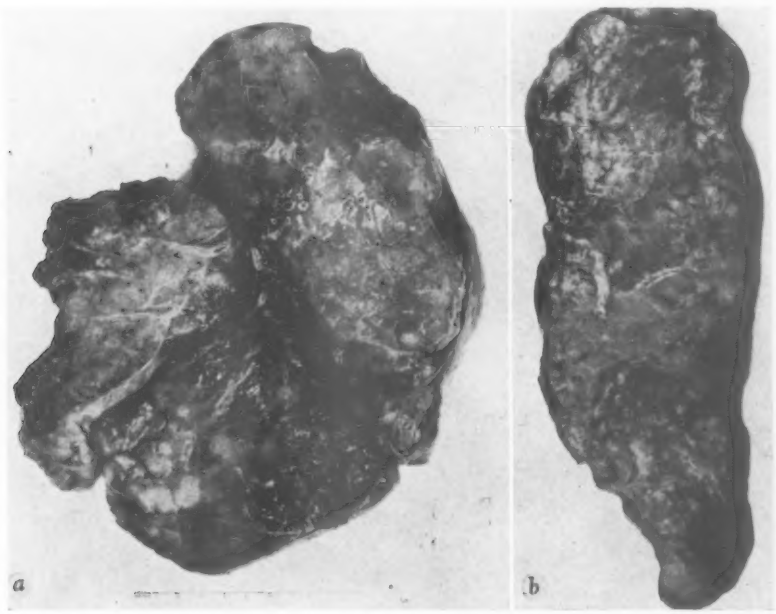

Fig. 9. *a*. Right lung, Case v. All three lobes are involved by alveolar cell tumor. The tumor in the upper and middle lobes is diffusely distributed, while in the lower lobe it is more nodular. *b*. Left upper lobe, Case vii. A portion of the lobe is consolidated by alveolar cell tumor.

The tendency for the tumor to be found in more than one lobe of the lung and to be present in scattered nodules suggests that the tumor may originate in multiple foci which tend to become confluent as time progresses. In this respect our cases are similar to those reported in the literature.

In approximately 50 per cent of the cases which have been reported in the literature there have been regions of metastasis. We have observed metastasis in only 2 of our 12 cases (Cases x and xii). In both instances the peribronchial lymph nodes were involved. In 1 case the liver was also in-

volved, and in another the adrenal glands. It is possible that the difference in the number of metastatic phenomena noted in our cases and in those reported in the literature can be explained on the basis of earlier observation, since the majority of our patients underwent operation for what appeared to be localized lesions.

We have been impressed by the lack of bronchial involvement in the cases of alveolar cell tumor which we have seen. In

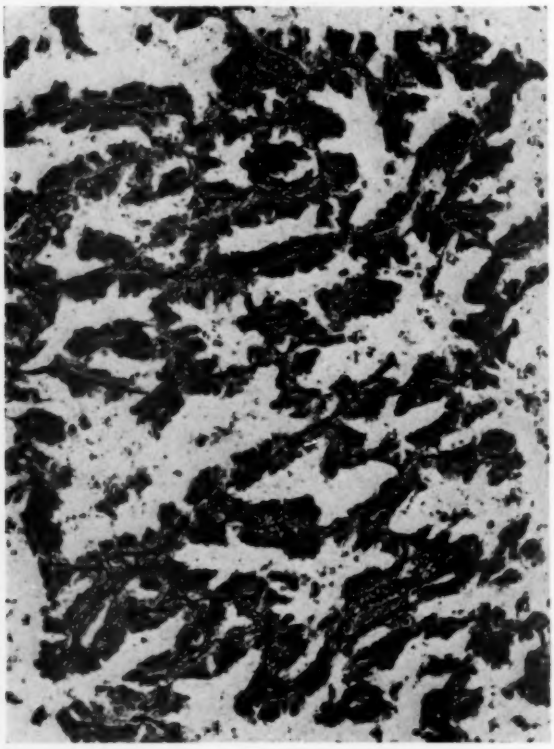

FIG. 10. Alveolar cell tumor demonstrating intact, thin interalveolar septa lined by tumor cells, Case II. (Gömöri reticulum stain ×130.)

only 2 instances was a positive bronchoscopic biopsy obtained (Cases VI and X). In 3 instances (Cases III, X and XI) the bronchoscopist noted an abnormality in the bronchial tree. In no instance was a definite area of ulceration or a definite tumor mass seen.

All of our cases exhibited a remarkable lack of pleural involvement, although in several cases puckering of the pleura could be made out. In at least 1 instance (Case VIII) fluid was present in the pleural space.

HISTOPATHOLOGY

In all of the cases which we have included in this series there were thin interalveolar septa lined by columnar cells which formed papillary projections into the alveoli. The interalveolar septa were demonstrated by the Gömöri reticulum stain (Fig. 10). We believe it is essential for a diagnosis of alveolar cell tumor that the interalveolar septa be thickened only slightly or not at all, and that there be little evidence of an inflammatory reaction.

Mitotic figures have been very scarce in all of our specimens. The cytoplasm of the cells either has been clear or has stained pink. The clarity of the cytoplasm is usually due to the presence of mucus, which can be demonstrated by the mucicarmine stain. This mucus is frequently secreted into the diseased pulmonary alveoli and may spill over into the adjacent undiseased alveoli.

In all instances the nuclei of the cells have been fairly regular. However, the size of the nuclei has varied and we have tried to connote this variation by establishing a method of grading (Fig. 11). Our cases are grouped into grades 1, 2, 3 and 4. Those cases showing the most regular cells with the smallest nuclei are placed in grade 1, while those with the largest nuclei and the least regular cells are put in grade 4. It is possible that the cases which fall into grades 1 and 2 may belong to that group of cases described in the literature under the term "pulmonary adenomatosis." All of the cases graded 1 and 2 in our series were surgical. Four of the 6 cases placed in grades 3 and 4 were observed at necropsy. Both of the cases in which the tumor was called grade 4 showed evidence of distant metastasis (Fig. 12). We believe that this differentiation by means of apparent cellular activity may eventually prove helpful in determining the future clinical course, particularly in regard to the metastatic potentiality of these tumors. It must be remembered, however, that the most benign-appearing alveolar cell tumor, even though it be incapable of metastasis, is capable of involving all of the lobes of the

lungs and thus causing death by suffocation.

The lipophages which were seen within the alveoli in practically all of our cases often appeared to originate from the tumor cells. Such a phenomenon was noted by Neubuerger and Geever and is very difficult to explain. Previously Watts and one of us[12] had noted phagocytic properties in the epithelial cells lining the pulmonary alveoli in a group of cases of bronchiectasis.

HISTOGENESIS

It is still a debatable point whether or not the pulmonary alveoli are lined by epithelium. In alveolar cell tumor there is no question but that the alveoli are lined by neoplastic epithelial cells. The debatable point has been whether these cells originate from epithelial cells lining the alveoli or whether they arise from the cells of the respiratory bronchioles and grow peripher-

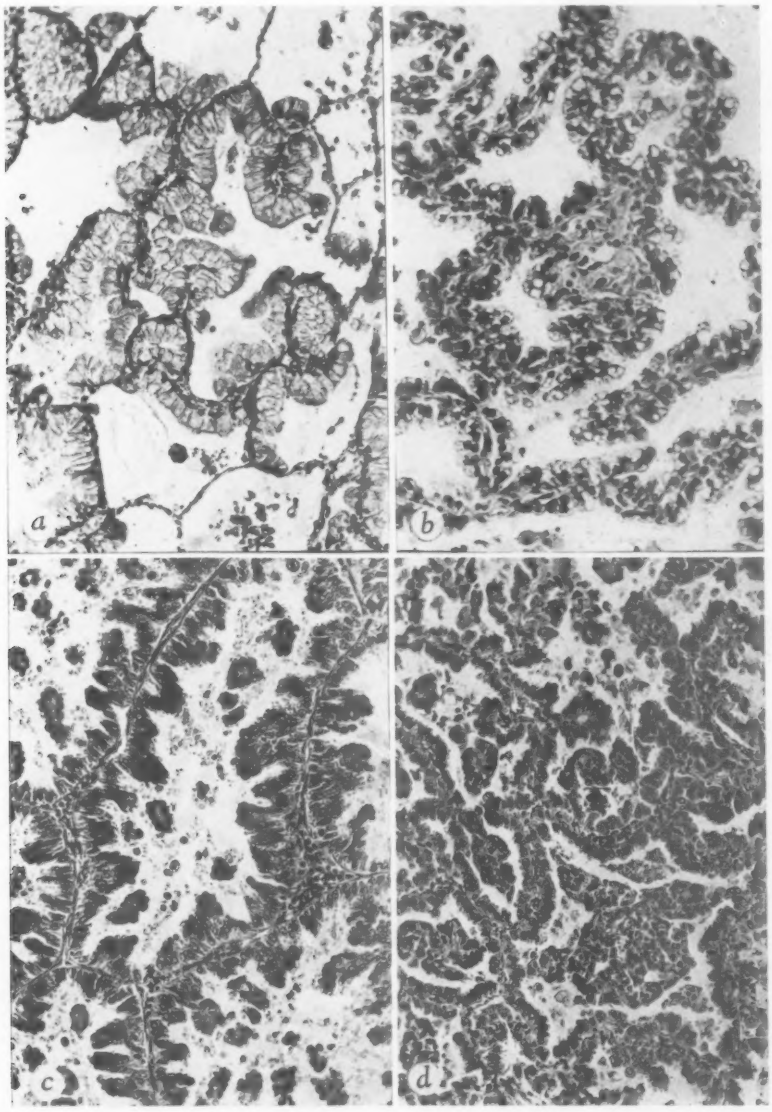

Fig. 11. Histopathologic appearance in four different alveolar cell tumors demonstrating increasing anaplasticity from *a* to *d*. *a*, grade 1, Case v; *b*, grade 2, Case vii; *c*, grade 3, Case iii; *d*, grade 4, Case xii. Metastasis occurred in Case xii. (Hematoxylin and eosin ×125.)

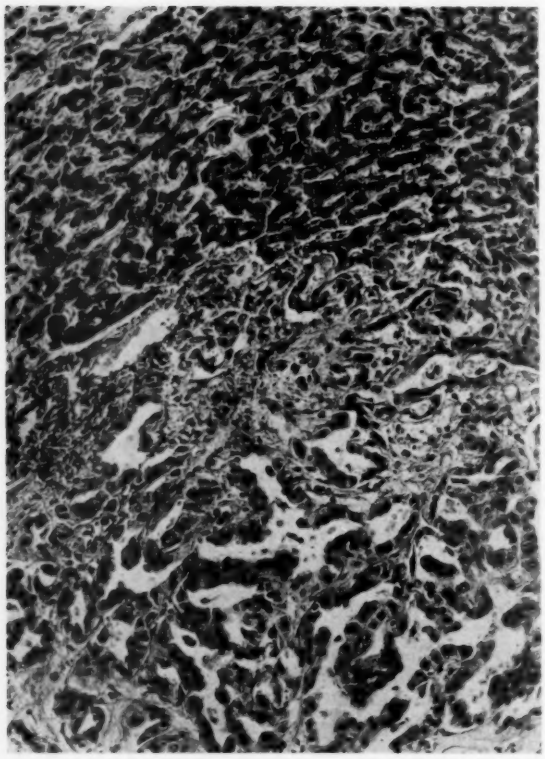

FIG. 12. Hepatic metastasis from an alveolar cell tumor, Case XII. The microscopic appearance of the primary tumor in the lung in this case is shown in Figure 11*d*. (Hematoxylin and eosin ×105.)

ally to line the alveolar spaces. We have found it impossible to settle this point of argument.

CYTOLOGIC EXAMINATION OF SPUTUM AND BRONCHIAL SECRETIONS

The results which have been obtained by the cytologic examination of sputum and bronchial secretions in the various types of carcinoma of the lung have been reported by Woolner and one of us.[14] Sputum and bronchial secretions were examined in 6 of the 12 cases in this series. In the other 6 cases no cytologic examination was performed, because the patients were observed prior to the time when this examination was being done. Positive results were reported in 4 of the 6 cases examined. In 3 of these 4 cases the positive results were reported on the basis of examination of the sputum. In 1 patient (Case III) no sputum could be obtained, and the positive cytologic report was based on observation of the bronchial secretions obtained through the bronchoscope at the time of bronchoscopy. In retrospect 1 of the cases reported as negative (Case IV) would at the present time be reported as positive. At the time of examination of the sputum in this case we had not gained sufficient experience with cytologic examination to feel justified in reporting the presence of neoplastic cells, although it was recognized that abnormal cells were present in the specimen.

In 2 of the 4 cases that were reported as showing the presence of neoplastic cells (Cases VI and VII) it was suggested that the neoplastic cells were of the alveolar cell type. In the remaining 2 cases reference was made only to the presence of carcinoma cells. Cells from an alveolar cell tumor can be recognized cytologically because they are larger than the cells normally present in sputum (Fig. 13). They are frequently more irregular, the nuclei are not prominent, the cytoplasm is pink staining and is occasionally distributed in a crescent around the nucleus. In several cases this crescent-shaped appearance has been so marked that the tumor cells have had the appearance of the cells of the squamous type of carcinoma.

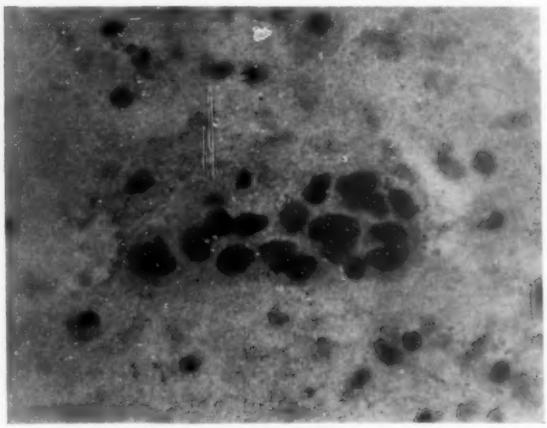

FIG 13. Sputum of a patient with bilateral alveolar cell tumor, Case VI. The nuclei are irregular but show no nucleoli. The clump of cells represents an exfoliated papilla. (Hematoxylin and eosin ×550.)

In 2 instances certain characteristics have enabled us to suggest that the neoplastic cells belong to the alveolar cell type.

It is possible to suggest such a diagnosis when clumps of columnar cells are present which have a free border of cytoplasm and in which the nuclei are not particularly irregular. Such clumps of cells represent the papillary projections of the tumor which have broken off into the alveoli and thereby reached the sputum. Our experience would indicate that the cytologic examination of sputum and bronchial secretions is a very valuable aid in the detection and diagnosis of alveolar cell tumors of the lungs.

BIOLOGIC STUDIES

It occurred to us that the possible origin of these tumors from a virus might be settled by injecting suspensions of ground-up tumor tissue into the lungs of various animals. Consequently a portion of the lower lobe of the fresh surgically removed lung in Case VI was ground into a fine emulsion with saline solution and frozen immediately. The following day this material was injected directly through the thoracic wall by a trochar into the lungs of 2 sheep, 2 dogs and 2 rhesus monkeys. A small, untreated portion of the fresh tumor from the same case was also inoculated into the anterior chamber of one eye in each of 5 guinea pigs. No changes have been noted in the sheep, dogs or monkeys during the period of observation, which has lasted nine months, nor did the tumor grow in the anterior chamber of the eye of any of the guinea pigs. These latter animals were killed and the microscopic sections have shown complete regression of the tumor. This limited experiment does not, of course, prove that a virus is not the etiologic agent.

CLINICAL MANIFESTATIONS

Seven of our patients were women and 5 were men. All belonged to the Caucasian race. The average age was forty-nine years. The youngest patient was thirty years of age and the oldest was sixty-two years of age. The average duration of symptoms at the time the patients were first seen was one year. Six of the patients had had symptoms for longer than one year, while the duration of the illness had been less than one year in 6 instances.

The symptoms of which the patients complained most commonly were cough with the production of sputum, dyspnea and hemoptysis. All of the patients complained of cough in some degree but in only 8 cases was sputum produced. In 3 instances the sputum was described as being clear or white, profuse and frothy. This is the type of sputum which has been associated most frequently with this disease in the cases reported in the literature. In 2 instances in our series the sputum was frankly purulent. Blood was present in the sputum of 5 patients at some time or other during the course of their illness. Eight patients complained of dyspnea and in 2 instances this was so severe that administration of oxygen was required in an attempt to relieve the patient. Less common symptoms were fever, pain, fatigue, weakness and loss of weight. Four patients reported the loss of more than 10 pounds (about 4 kg.), 1 patient (Case XII) having lost a total of 90 pounds (about 41 kg.)

Except for the finding of carcinoma cells in the sputum or bronchial secretions, the only laboratory test of possible significance was the blood sedimentation rate. This was recorded in 8 of the 12 cases and ranged from 14 mm. per hour (Westergren) to 69 mm. per hour. In 5 of the 8 cases in which the sedimentation rate was recorded it was more than 30 mm. per hour.

Bronchoscopy was performed in 10 of the 12 cases. In 3 instances some abnormality of the bronchial tree was noted. In none of the patients was a tumor seen nor was there evidence of ulceration of a bronchus. Nothing of significance was seen in the bronchial tree in 7 of the 8 patients who underwent surgical procedures, although in 1 instance (Case VI) a bronchoscopic biopsy was reported to show alveolar cell tumor. In 1 instance in which operation was not performed a positive biopsy was obtained by the bronchoscopist. In another instance bronchoscopic biopsy on three separate occasions showed only inflammatory tissue.

One of the patients who subsequently came to necropsy received roentgen therapy. His condition was thought to improve for a short time, but he died within five months.

The clinical diagnosis in the 8 cases in which surgical exploration was eventually performed varied from a definite diagnosis of carcinoma to one in which no diagnosis was made and the exploration was planned in order to establish a diagnosis. A definite preoperative diagnosis of carcinoma was made in 4 of the 8 instances. In 2 cases it was thought that the lesion was inflammatory, and in 2 others exploration was advised for the purpose of making a definite diagnosis.

In the case of the 4 patients who died and on whom necropsy was performed a clinical diagnosis of carcinoma was made in 1 instance on the basis of a positive bronchoscopic biopsy. In another case a diagnosis of carcinoma or of possible broncholithiasis was entertained. In a third case (Case IX), which was observed in 1914, a diagnosis of bilateral fibroid tuberculosis was made. In 1 case (Case XII) the patient died before any conclusion could be reached.

ROENTGENOLOGIC MANIFESTATIONS

In all of the 12 cases in this series the roentgenogram of the thorax which was made at the time of admission showed definite evidence of pulmonary disease. In 8 instances the process appeared to be confined to one lung, while in 4 the lesion was definitely bilateral.

In 6 instances the lesion was described as an indefinite area of pneumonitis or consolidation in a particular lobe or segment of a lobe. Usually the shadow was not sufficiently well circumscribed to be called a mass. The area of involvement ranged in size from a spot about 3 cm. in diameter (Case II) to involvement of an entire lobe (Case III). In spite of the fact that in these 6 instances the roentgenologist thought he was dealing with an area of pneumonitis, he suggested the possibility of a neoplasm as the cause of the pneumonitis in 3.

In 4 instances (Cases V, VI, X and XI) a shadow was sufficiently well defined to be called a mass. In 3 of these cases (Cases VI, X and XI) lesions were also present in the opposite lung. In the other (Case V) multiple lesions were noted in one lung only. In each of these 4 cases the roentgenologist suggested a diagnosis of neoplasm, either primary or secondary, and mentioned the possibility of a primary neoplasm with metastasis in the same lung.

In 2 cases the involvement was bilateral and diffuse without the formation of a local mass.

From a study of the 12 cases in this series it would seem that the earliest form of involvement by alveolar cell tumor is a small, poorly defined area of consolidation similar to the pneumonitis seen following bronchial obstruction or in conjunction with atypical pneumonia. As the disease progresses it may involve more and more of a lobe of the lung until the entire lobe is involved. As the disease develops further, other centers of involvement become apparent either in the same lobe, in the same lung or in the opposite lung. Whether these shadows represent a multicentric origin or whether they represent secondary centers of activity cannot be stated definitely. Certainly in the advanced stages both lungs are involved with multiple foci. These nodules frequently become confluent and may give the appearance of a mass or of a consolidated lobe. During this stage of the disease the involved portions of the lungs are relatively airless, and these patients usually exhibit marked dyspnea and even cyanosis.

There is nothing in the appearance of the roentgenogram of the thorax in the 12 cases in this series which allows a definite diagnosis of alveolar cell carcinoma to be made. In the earlier stages the lesion may be confused with pulmonary abscess, with bronchiectasis or with chronic pneumonitis secondary to bronchial obstruction from any cause. Because of the age at which these lesions are encountered bronchogenic carcinoma will always be one of the possibilities considered. When the involvement is bilateral and diffuse, a

metastatic malignant lesion, the diffuse granulomas, such as tuberculosis, sarcoidosis and those caused by various fungi, and pneumoconiosis will be considered in the differential diagnosis.

Because bronchoscopy usually uncovers nothing of significance it is not expected that bronchography will prove to be very valuable. A bronchogram was made in 1 instance in this series (Case 1) (Fig. 1*b*). It showed evidence of incomplete filling of the bronchial tree in the involved portion of the lung, but there was no evidence of an intrabronchial lesion. It could not be determined from the bronchogram whether the filling was incomplete because of bronchial obstruction or because of technical reasons.

SURGICAL CONSIDERATIONS

It is impossible at this time to offer a definite opinion regarding the effectiveness of pulmonary resection in the treatment of alveolar cell tumor of the lung. The number of cases in which operation has been performed is too small and the period of observation is too short to permit a definite statement. However, it should be pointed out that 1 of the patients for whom resection was performed is still alive without evidence of residual or recurrent disease two years after operation, another six months after operation and a third three months after operation. One patient died two years after operation of causes unrelated to her alveolar cell tumor. In addition it was noted at necropsy in 2 patients who died after operation that there was no evidence of residual disease in the remaining pulmonary tissue. It should also be noted that patients who were operated upon successfully were relieved of their hemoptysis and their annoying and productive cough. Pulmonary resection seems at least to have considerable merit as a palliative measure.

It has been our policy to advise surgical exploration of all indeterminate pulmonary lesions provided, of course, that the patient's condition will permit. That this is a sound policy is indicated by a series of 114 cases of indeterminate pulmonary lesions in which exploration was performed. In 65 per cent of this group carcinoma of the lung was proved at operation to be present, and the remaining cases consisted of a variety of lesions, such as pulmonary abscess, hamartoma, tuberculoma, bronchial cyst, and so forth, all of which are best treated by surgical resection. In following this policy it is inevitable that we shall continue to carry out exploratory thoracotomy and pulmonary resection in an occasional case of alveolar cell tumor of the lung, since these lesions cannot be diagnosed definitely preoperatively in many instances.

We believe that the extent of pulmonary resection performed for alveolar cell tumor of the lung should be as conservative as the extent of the lesion will permit. In this series lobectomy was performed in 5 cases, pneumonectomy in 2, and in 1 bilateral lobectomy was performed.

Further experience may indicate that pulmonary resection is not the treatment of choice for alveolar cell tumor of the lung. However, at the present time it is the only treatment available for this lesion. Our experience to date suggests that it has some therapeutic and palliative value. Furthermore, experience gained from resection in these cases is the only way we have of determining the effectiveness of this treatment and of gaining information about the growth and development of this particular pulmonary lesion.

CONCLUSIONS

We believe that alveolar cell tumor is a distinct pathologic entity. It is a condition which is relatively rare but which will probably be encountered more frequently because of the present willingness of thoracic surgeons to explore lesions in the lungs for which a definite preoperative diagnosis cannot be made. The condition is progressive and will ultimately cause the death of the patient by suffocation or by involvement of distant organs.

Roentgenologic examination is valuable because it can locate the lesion and may at

times be the first indication that the disease is present. It is useful in outlining the extent of the disease and it aids in establishing operability. The roentgenologic examination alone will not establish the diagnosis.

Although bronchoscopic examination is seldom of value in identifying the lesion, material obtained through the bronchoscope, either as tissue for biopsy or as secretions from the bronchial tree, may, when examined microscopically, enable one to establish a definite diagnosis.

The most valuable single aid in diagnosis is the cytologic examination of sputum or bronchial secretions. In the majority of instances this examination should indicate that a neoplastic process is present in the lungs and on some occasions may even offer a definite diagnosis of alveolar cell tumor.

Although the clinical history may be helpful when typical sputum is present in conjunction with cough and dyspnea, the history may be no different from that obtained from patients with other types of pulmonary disease. Cough is a prominent feature and hemoptysis is frequent. Loss of weight may or may not occur.

Surgery offers the only effective treatment which is known at the present time. It is indicated whenever the lesion is localized to one lung or one lobe of the lung. Although it is too early to draw conclusions and the material which forms the basis of this report is too small, it would seem that pulmonary resection may at least alleviate the patient's symptoms and may even offer hope for a cure. Further study and observation of cases will decide whether or not lasting cures can be obtained.

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DISCUSSION

DR. DONALD B. EFFLER, Cleveland, Ohio. Dr. Good has elected to discuss this interesting pathological condition under the term "alveolar cell tumor." This term was used in 1942 by Neubuerger, who reported on 37 cases of this disease collected from world literature. There is evidence, however, that the disease may not be entirely alveolar in origin, and as such might require broader definition. In a paper on this subject to be published, Stockton and myself have written under the term "multicentric papillary adenocarcinoma of the lungs." As recognition of the disease improves clinically, I

am sure we can anticipate a single inclusive term to label this disease. At the present time it is written about under "primary multiple carcinoma," "alveolar cell carcinoma," "columnar cell carcinoma," "alveolar cell tumor," "pulmonary adenomatosis," "malignant adenomatosis" and "multiple nodular carcinoma." The wide variance in the terminology has been confusing and will demand clarification before this entity can be brought to the attention of the profession at large.

Dr. Good has also pointed out the difficulty in making a clinical diagnosis in alveolar cell tumors. In a review of 34 cases Stockton found that cough was present in 85 per cent of those reported, dyspnea in 58 per cent, weakness and weight loss in 38 per cent. There is one symptom, however, that is reported in 32 per cent of cases, and is said to be almost pathognomonic when it is present, and that is a profuse watery sputum which may exceed 1,500 cc. per day. I would like to present one case from the Cleveland Clinic in which this characteristic sputum was the outstanding clinical feature during the course of the patient's disease.

The patient was a white male, aged seventy-six, admitted on November 16, 1948. At that time he gave a history of a six months chronic productive cough, raising 8 to 10 ounces of a thin, frothy, white sputum. Roentgenographic studies of his chest showed a homogeneous density extending peripherally from the right hilus to involve most of the right lower lobe. The left lung field and the upper half of the right lung field were clear. Diagnostic bronchoscopy showed no gross abnormalities with the exception of large amounts of white frothy sputum exuding from the right lower lobe bronchus. In retrospect the clinical evidence supported the diagnosis of multicentric papillary adenocarcinoma rather than the supposed bronchogenic carcinoma. A right lower lobe lobectomy was performed on December 8, 1948. The cut surface of the specimen showed broad areas of firm consistency studded with minute firm grayish-white foci about 1 mm. in diameter. When scraped, the cut surface showed a sticky gray mucoid material. The microscopic studies were reported as typical for pulmonary adenomatosis or muticentric papillary adenocarcinoma. The epithelial cells were described as in a single layer, often mucus secreting and at times of the goblet type. The nuclei were large, round, basal in position, and at times hyperchromatic with a few mitotic figures. In most areas the epithelium had a papillary arrangement. One lymph node was replaced in part by mucus-secreting epithelial cells. The immediate postoperative course was remarkably uneventful and the patient was discharged on the tenth postoperative day, at which time the cough had disappeared entirely and he was no longer bringing up sputum. Roentgenographic studies of the chest showed no evidence of residual pulmonary disease. Approximately one month after operation the cough recurred and the patient again began to bring up amounts of thin frothy sputum. The patient was re-admitted to the hospital on March 10, 1949, and showed a marked degree of emaciation. The temperature and the pulse were normal, however. A roentgenogram of the chest showed diffuse soft nodular mottling of both lung fields, and was interpreted as a widespread recurrence of the original malignant process. The patient was first given a course of nitrogen mustard therapy which resulted in a very slight, but temporary, improvement of his general condition. He continued to bring up 8 to 10 ounces of sputum daily. Aureomycin was then given to the patient for a period of two weeks with no evident results. As a last resort he was given a full course of roentgen therapy, which had no effect on his gradual retrogressive course. The patient finally died on April 23, 1949. At necropsy the pertinent findings were limited to the content of the chest and there were no distant metastases. The remaining four lobes were all involved and showed the typical multiple papillary projections of the tumor.

This case is presented for two reasons: first, to demonstrate the malignant fulminating character of which the disease is capable; and second, to show its resistance to several therapeutic agents which had been recommended elsewhere in the literature, but to the best of my knowledge had not been given a therapeutic trial.

In our opinion the disease has a very poor prognosis, although there may be occasional cases where surgery will cause a prolonged remission. The disease may be suspected by its roentgen finding, and the profuse watery sputum which is present in approximately 30 per cent of cases, but the actual diagnosis still depends upon tissue studies made at the time of exploratory thoracotomy.

Dr. Good is to be commended for his concise presentation of a very difficult subject, and the presentation of a remarkably large series of cases.

SPONDYLARTHRITIS IN CHILDREN*

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NON-TUBERCULOUS lesions of the spine in children are uncommon and their etiology often obscure. Recently at Children's Hospital, a syndrome characterized by a rather typical roentgenological pattern has been studied. The syndrome appears to be a low grade inflammatory process involving both the intervertebral disc and adjacent vertebral bodies. In some of the cases there is clinical evidence of infection. Since both the intervertebral disc and vertebrae are involved, the term "spondylarthritis" seems most descriptive.

CASE REPORTS

CASE 1 (Fig. 1). B. B., female, white, aged two years, was admitted to Children's Hospital on October 19, 1946, with a history of limping on the right leg and refusal to sit because of pain in the right hip. The symptoms had lasted for two weeks, and during this period the child had become irritable and had lost her appetite. There was a low grade fever of 99° F.

Physical examination showed a well developed and nourished, very irritable child who walked with a limp of the right leg. There was a maculopapular rash over the right buttock. The right trochanter seemed higher than the left. There was limitation of extension and circumduction of the right hip. The lumbar spine appeared very stiff, and there was limitation of flexion in the lumbar region. Reflexes were normal. Temperature on admission was 100.8° F.

Laboratory studies were essentially normal. The leukocyte count varied between 6,700 and 15,250, finally reaching 5,250 on discharge on January 7, 1947. Urine was normal. Tuberculin and histoplasmin skin tests were negative in all strengths. Agglutinations for typhoid, paratyphoid and brucellosis were negative. Blood cultures were negative. Sedimentation rates were normal. Blood serological findings were negative.

The course in the hospital was uneventful. There was a low grade fever of about 99°F. with occasional rises to 101° or 102° F. for nine weeks. The child received a total of 6,600,000 units of penicillin intramuscularly from November 8 to December 24. She was placed in a plaster body jacket extending to the knees and was sent home. She was readmitted on January 2, 1947. Examination then revealed a full range of painless motion of all extremities. Examination of the back revealed no tenderness but moderate spasm and restriction of flexion and extension remained. The child was kept in a body jacket until May, 1947. Her recovery was uneventful, and she is now well.

Roentgen Findings. Examination of the pelvis and femurs on admission showed no abnormalities. On October 23 the lumbar spine showed a left scoliosis of the lower lumbar spine with narrowing of the intervertebral space between the third and fourth lumbar vertebrae. There was a destructive process involving the articular processes of the involved vertebrae resulting in narrowing of the intervertebral space chiefly on the right side. Re-examination of the lumbar spine on October 30 showed further narrowing of the interspace between the third and fourth lumbar vertebrae with demineralization of the pedicles on the right. Demineralization of the adjacent portions of the bodies of the third and fourth lumbar vertebrae was also noted. On November 3 the narrowing had progressed slightly.

On January 10, 1947, the narrowing of the intervertebral space was less than on the previous examinations. The pedicles on the right appeared normal and the articular processes were better defined. There was sclerosis of the adjacent portions of the two vertebral bodies and their borders were better defined.

Re-examination on April 9, 1947, showed further widening of the intervertebral space between the third and fourth lumbar vertebrae. The sclerosis of the vertebral bodies persisted and their adjacent surfaces showed a somewhat saw-tooth and flattened appearance. There was no longer any scoliosis of the spine.

* From the Children's Hospital and Department of Radiology, College of Medicine, University of Cincinnati. Presented at the Fiftieth Annual Meeting, American Roentgen Ray Society, Cincinnati, Ohio, Oct. 4–7, 1949.

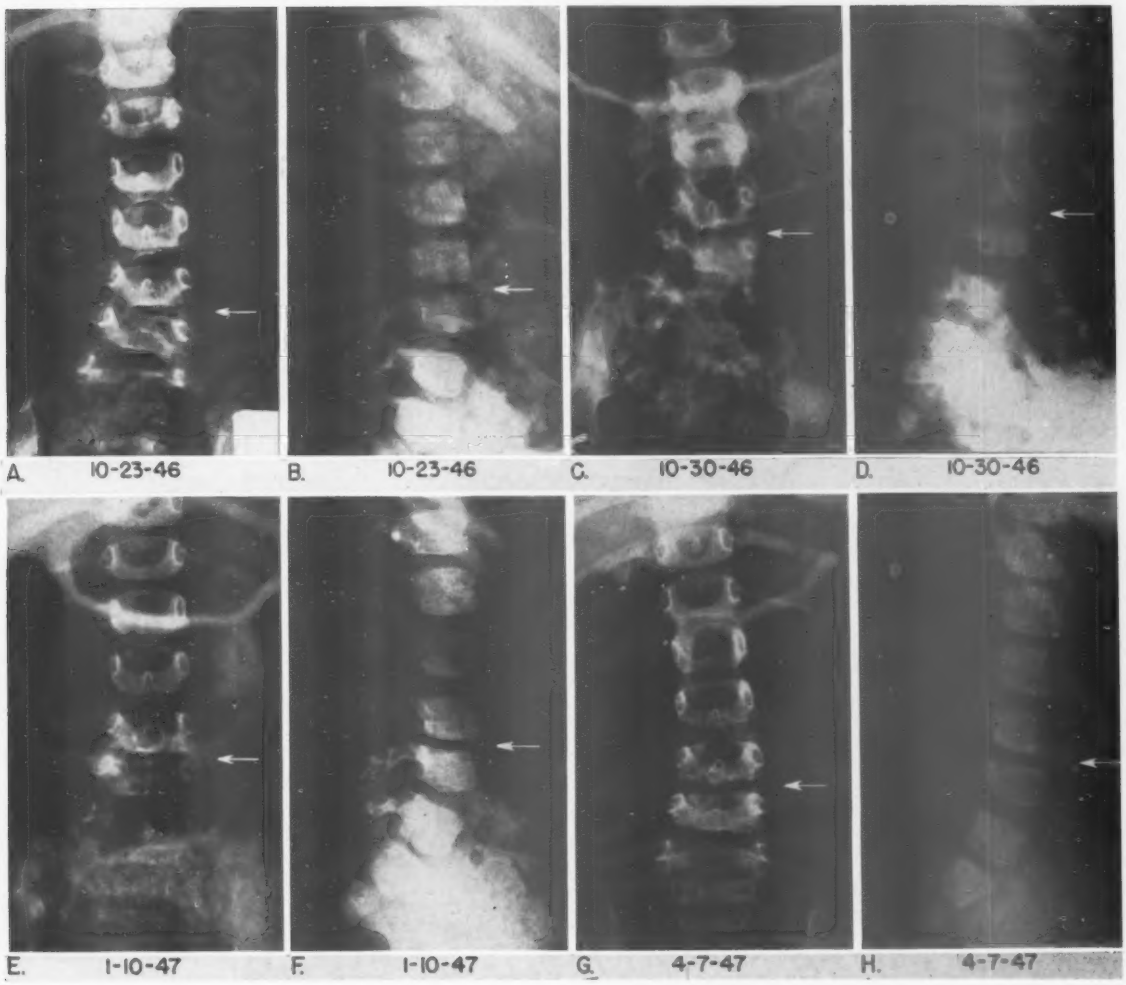

Fig. 1. Case 1. B. B., female, white, aged two and a half. Note the gradual narrowing of the interspace between the fourth and fifth lumbar vertebrae and the gradual restoration to a nearly normal appearance.

Case II (Fig. 2). D. D., male, white, aged fourteen, was admitted to Children's Hospital on June 25, 1946, with a chief complaint of pain in the left hip. Five days before admission the child awoke complaining of continuous, dull, aching pain about the left hip and buttock. He ascribed the pain to work mowing grass. He was unable to continue his work and walked with a limp. Two days after the onset of pain the symptoms became worse and the boy became unable to walk. His temperature was 103° F. He was put to bed and given sulfadiazine for two days. On the day before admission he received 100,000 units of penicillin in oil.

Physical examination on admission showed a thin, well developed white boy, not acutely ill, who walked with a limp and favored the left hip in all motions. Temperature was 101.2° F., pulse 130, respirations 26 per minute. There was point tenderness over the mid-portion of the left buttock. There was marked limitation of motion of the left hip, especially of internal rotation and abduction. There was pain and limitation of motion of a lesser degree on flexion and extension. No other abnormalities were found at that time.

Laboratory Findings. On admission the leukocyte count was 15,500 with 86 per cent neutrophils. On July 6 the leukocyte count was 14,750 with 66 per cent neutrophils, and on July 16 was 8,200 with 52 per cent neutrophils Urine was normal. Blood culture was negative as were agglutinations for typhoid, paratyphoid and brucellosis. Sedimentation rate on July 9 was 40 mm. in one hour and on July 16, 29 mm. in one hour (Wintrobe method). Tuber-

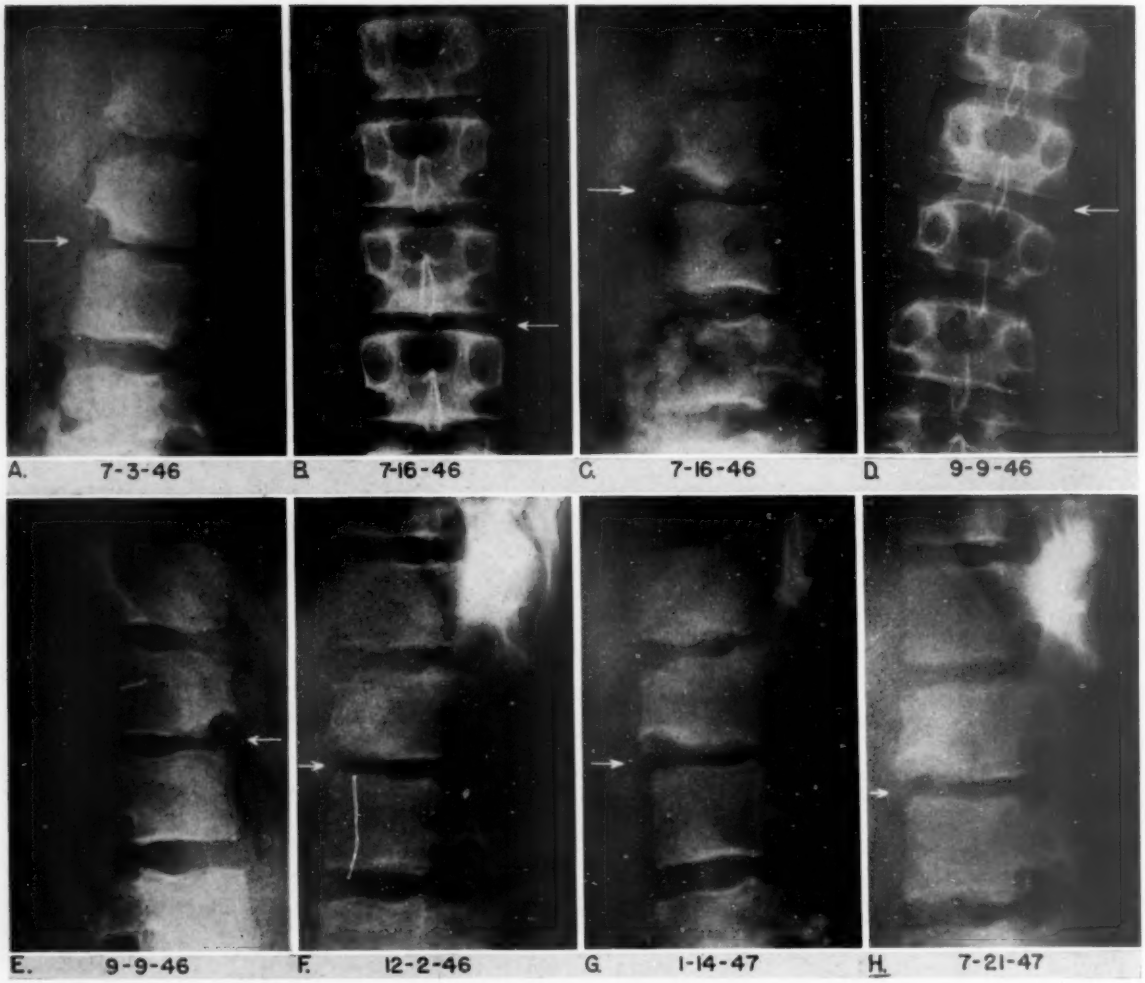

Fig. 2. Case II. D. D., male, white, aged fourteen. Note the narrowing between the second and third lumbar vertebrae. There is slight destruction of the adjacent surfaces of the vertebral bodies which eventually heals.

culin tests in all strengths were negative.

Course. On admission the patient was started on 25,000 units of penicillin every three hours, which was continued until July 8. The temperature fell to normal on the eighth hospital day and remained normal. The left leg was placed in skin traction. On July 1 tenderness over the second lumbar vertebra was found on percussion of the spine, but there was no limitation of motion of the spine. Leg traction was stopped on July 7. At that time flexion of the left hip was limited to 90°; there was no limitation of external rotation and extension. Internal rotation was limited to 10°. On July 10 there was a full range of motion. The patient was discharged on July 24, with no complaints. On August 12 he was fitted with a Taylor back brace and was permitted to walk. Since then the boy has had no complaints. He continued to wear the brace for one year and at present is well.

Roentgen Findings. On admission on June 25, 1946, stereoscopic roentgenograms of the pelvis showed no abnormalities. The left psoas shadow appeared rather wide. Re-examination of the pelvis on July 1 and August 12 showed at all times *no abnormality of the left hip joint or femur.*

Examination of the lumbar spine on July 2 showed narrowing of the interspace between the second and third lumbar vertebrae. The inferior ring epiphysis of the second lumbar was not calcified anteriorly. On July 16, the narrowing of the interspace between the second and third lumbar vertebrae persisted. There was slight

sclerosis of the lower border of the body of the second lumbar vertebra. On August 12 there was progression of the erosion of the anterior, inferior surface of the body of the second lumbar vertebra and some demineralization and irregularity of the upper border of the third lumbar vertebra. The interspace remained narrowed.

On December 1 there was increased sclerosis of the inferior surface of the body of the second lumbar vertebra. The interspace between the second and third lumbar vertebrae appeared only slightly narrow and was wider than on the previous examinations. Additional roentgenograms of the lumbar spine on March 20, April 29 and July 21, 1947, showed persistent narrowing of the intervertebral space between the second and third lumbar vertebrae, with slight increase in the sclerosis of the vertebral bodies on their adjacent surfaces.

Case III (Fig. 3). S. T., female, white, aged two and a half, was admitted to Children's Hospital on August 11, 1946, complaining of low back pain. One month before admission the child fell out of a swing and landed on her back. About one week later she began to complain of backache. Hot applications to the back failed to relieve the pain. One week before admission the child's posture was abnormal. Past history and family history were not significant.

Physical examination on admission revealed a well developed and well nourished child in no apparent distress. There were marked dental caries. The back was held rigid on standing and sitting with moderate increase in dorsolumbar lordosis. On forward flexion in the standing and sitting positions, there was loss of the normal dorsolumbar curve and limitation of motion. Sideward and backward bending was normal. The straight leg raising test was normal, and the Trendelenburg test was negative bilaterally. The hips moved normally. There was no tenderness on percussion over the spinous processes.

Blood and urine examinations were normal. The leukocyte count on August 12 was 11,650, on September 13, 8,600, and on October 1, 5,900. Tuberculin and histoplasmin tests were negative in all strengths. Agglutinations for typhoid, paratyphoid A and B and brucellosis were negative. Stool cultures were negative. Sedimentation rates were normal.

The clinical course was entirely afebrile. The patient was kept at bed rest on her back. She was put in anterior and posterior plaster shells in slight hyperextension and discharged on October 10.

The child was kept in a cast until February 24, 1947. She was seen last on June 7, 1948, at which time she seemed entirely well and active. Physical examination of the spine showed no abnormalities.

Roentgen Findings. The initial examination on August 13, 1946, showed the pelvis to be normal. Examination of the spine showed beginning flattening of the superior surface of the fifth lumbar vertebra. There was definite narrowing of the interspace between the fourth and fifth lumbar vertebrae. The inferior left articular process of the fourth lumbar vertebra was poorly defined and there was a slight dextroscoliosis of the lumbar spine at this point. On August 30, there was beginning sclerosis of the vertebral bodies. On September 18, there was progressive narrowing of the intervertebral space between the fourth and fifth lumbar vertebrae with further sclerosis and also areas of decreased density in the adjacent portions of the vertebral bodies. Roentgenograms of the teeth showed marked dental caries. On August 30, the chest roentgenogram was normal.

On October 6, the narrowing of the intervertebral space and the sclerosis of the vertebral bodies persisted but by December 7, 1946, the narrowing of the intervertebral space was less as was the sclerotic lesion in the vertebral bodies. The left inferior articular process of the fourth lumbar vertebra was better defined. The process appeared to be healing.

On February 15, 1947 the interspace between the fourth and fifth lumbar vertebrae showed further widening indicating restoration of the vertebral disc. The vertebral surfaces remain somewhat flattened and dense. The articular processes appeared normal. On August 20, 1947, the intervertebral space showed excellent regeneration and on June 7, 1948, the lesion appeared arrested.

Case IV (Fig. 4). R. G., male, white, aged two and a half, was admitted to Children's Hospital on February 11, 1946, complaining of pain and stiffness of the lumbar spine. The pain began in September, 1945, and had been intermittently worse since then. Forward bending was restricted. General health was otherwise good although gain in weight was rather slow. The back pain became gradually more severe until the time of admission.

Past history revealed pneumonia at five

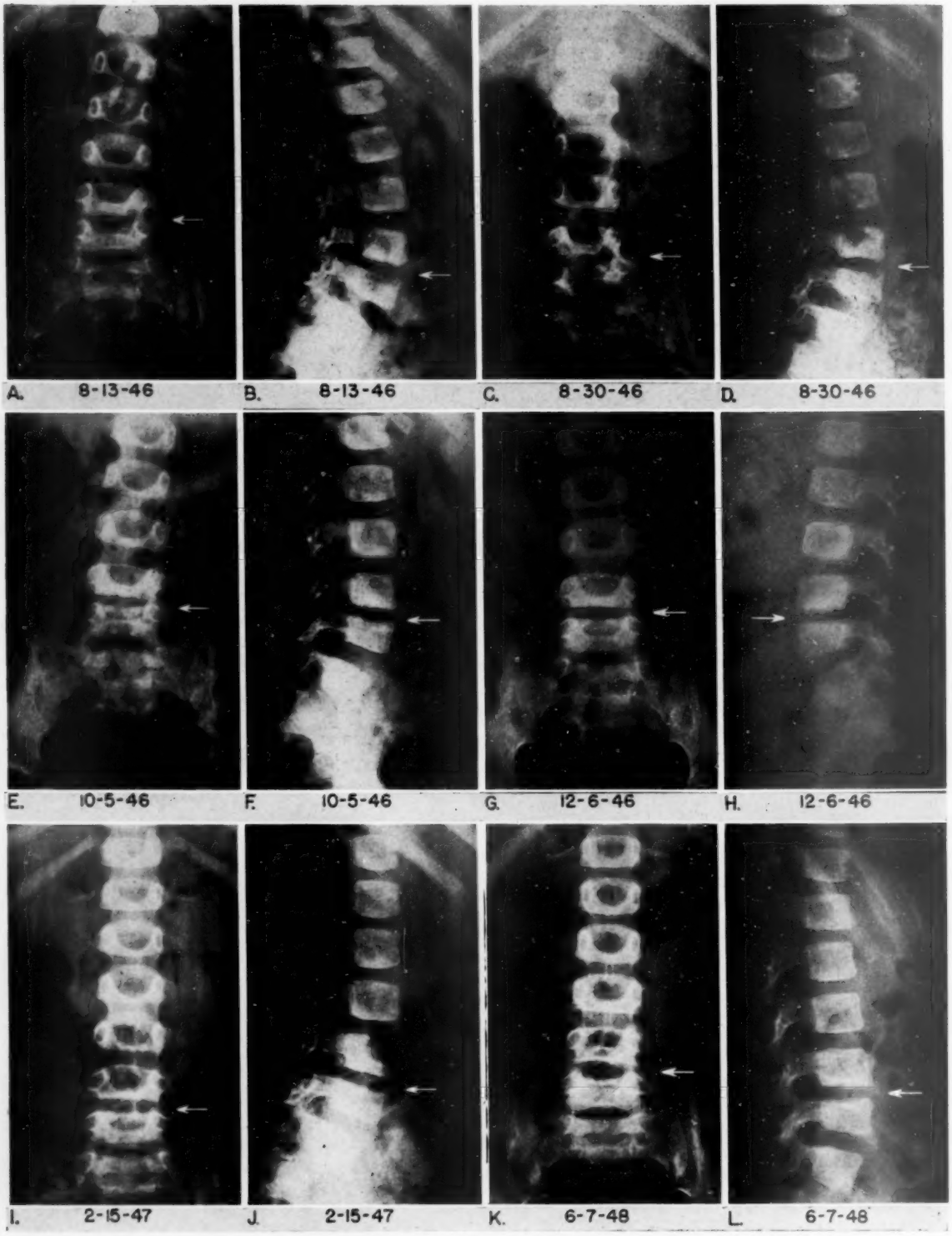

Fig. 3. Case III. S. T., female, white, aged two and a half. There is narrowing of the interspace between the fourth and fifth lumbar vertebrae, with slight destruction of the adjacent surfaces of the vertebral bodies with eventual restoration of the normal width of the intervertebral space.

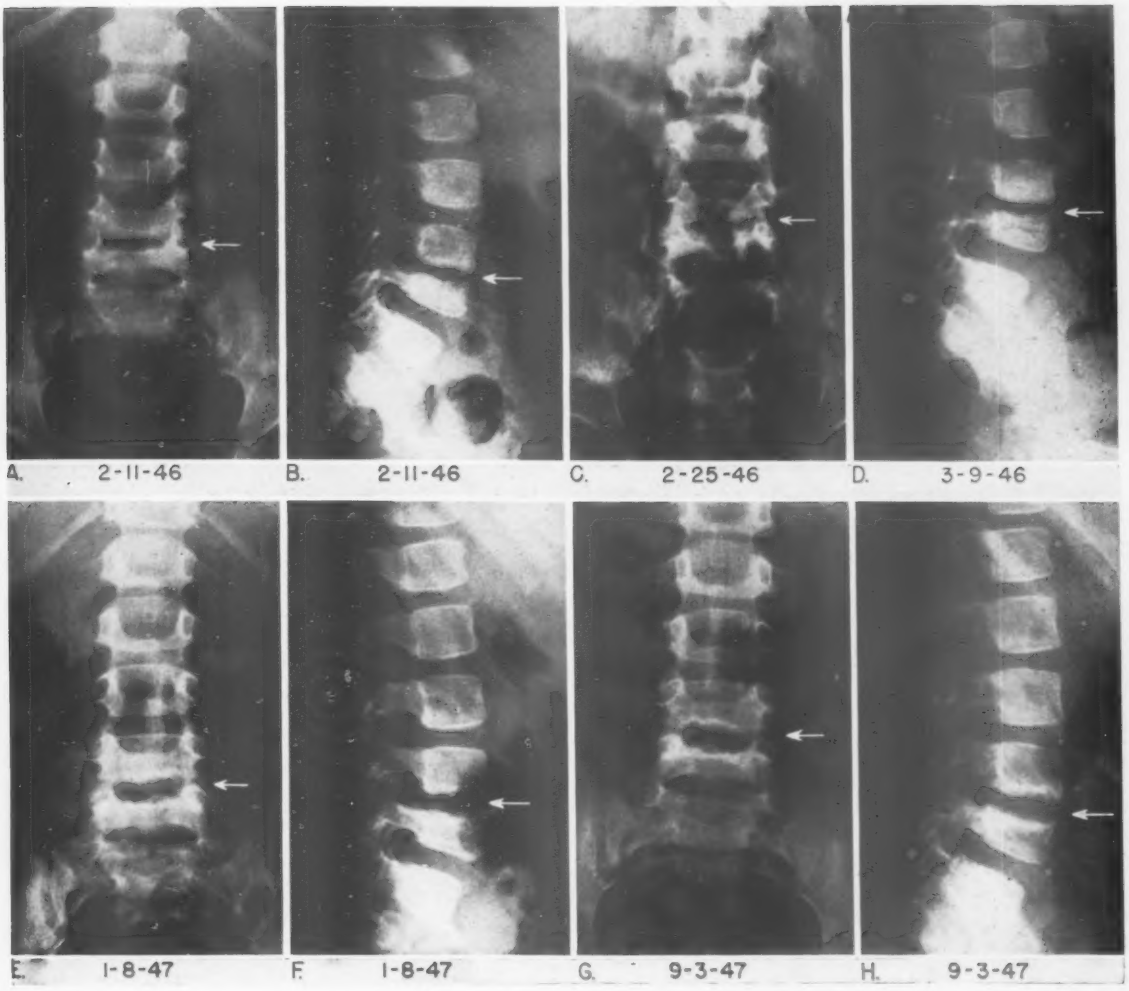

Fig. 4. Case IV. R. G., male, white, aged two and a half. Because this child was seen somewhat later after onset of his symptoms than the other children, the roentgen changes are more advanced on the initial examination. The interspace between the fourth and fifth lumbar vertebrae remains well preserved after one and a half years with moderate sclerosis of the adjacent surfaces of the vertebral bodies.

months. There was a questionable family history of tuberculosis.

Physical examination showed a well developed and well nourished boy in no acute distress. The cervical lymph nodes were moderately enlarged. The heart, lungs and abdomen were normal. The spine was held in rigid lumbar lordosis and there was resistance to flexion. The Kernig sign was positive bilaterally.

Laboratory Findings. Tuberculin and histoplasmin skin tests were negative in all strengths. Agglutinations for typhoid, paratyphoid A and B and brucellosis were negative on two occasions. Urinalyses were normal. The leukocyte count varied between 10,800 and 12,800 from February 12 to March 7, finally falling to 8,700 on April 2. Sedimentation rates were 47.0 mm. in sixty minutes February 18, and 14 mm. in sixty minutes on March 5 (Wintrobe method).

Clinical Course. Throughout his hospital stay, the patient ran an irregular low grade fever of about 99°F. with an occasional rise to 100° or 101°F. The child was kept on a Bradford frame until April 2, at which time a body cast was applied from the chest to the knees. The patient remained in the cast and later a body jacket until August 2, 1947. In September, 1947, a Taylor brace was applied and the child was sent home. In April, 1949, the patient was entirely asymptomatic with normal motion of the spine but was still wearing the back brace.

Roentgen Findings. On February 11, 1946,

the chest and long bone survey was entirely normal. Roentgenograms of the lumbar spine showed narrowing of the intervertebral space between the fourth and fifth lumbar vertebrae without scoliosis. There was irregular flattening and loss of substance of the superior surface of the fifth lumbar and some sclerosis in this area. There was some irregularity of the lower border of the fourth lumbar vertebra. Re-examination on February 25 showed little change. There was slightly increased flattening and sclerosis of the upper portion of the body of the fifth lumbar vertebra. There was no change in the body of the fourth lumbar. On January 8, 1947, the intervertebral space showed definite widening. There was an increase in the size of the bodies of the fourth and fifth lumbar vertebrae probably due to accelerated growth. The adjacent surfaces of these vertebral bodies remained irregular and sclerotic but the lesion appeared inactive. Examination on September 3, 1947, showed no further change in the appearance of the lower lumbar spine and roentgenograms taken elsewhere in April, 1949, are reported as showing the lesion to be inactive. The intervertebral space between the fourth and fifth lumbar vertebrae remains well preserved and the vertebral bodies remain somewhat deformed.

Cases I and II are excellent examples of the "hip joint syndrome" described by Guri.[8] In both of these patients although symptoms were referable chiefly to the hip, the anatomical lesion was found only in the spine. The criteria given by Guri are as follows:

1. Palpation of the posterior aspect of the articulation produces no pain.
2. Trochanteric percussion usually produces pain in the hip conditions but not in spinal conditions.
3. Restriction of motion is usually confined to the thigh.

Physical examination of the lumbar spine may then confirm the suspicion of a lesion in the lumbar spine by the following findings:

1. Presence of an area of tenderness over the lumbar spine.
2. Marked limitation of motion of the spine, especially flexion.
3. Pain in the lumbar spine following attempts at flexion of the leg. These two cases did not present all of the above criteria.

According to Cunningham[4] the nerve supply to the hip joint is obtained from the lumbar plexus via the femoral and obturator nerves and from the sacral plexus by twigs from the nerve to the quadratus femoris. The femoral and obturator nerves arise from the roots of the second, third and fourth lumbar vertebrae and the nerve to the quadratus femoris arises from the fourth and fifth lumbar and first sacral vertebrae. Hence it is possible to have the symptoms of this "hip joint syndrome" from a lesion arising almost anywhere in the lumbar spine. It is similar to the symptom of referred pain in the knee joint arising from a lesion in the hip joint.

DISCUSSION

In the present series 3 of the cases were in children of two to three years of age; 1 was in a boy of fourteen years. In 3 of the cases there was a history of some type of trauma. Three of the cases had a febrile course. Case I had a history of trauma but was afebrile. The relation between the trauma and the apparent infectious course cannot be proved. According to Wilensky,[13] trauma may help to localize infection in a vertebra by causing injury to the blood vessels so that an infected thrombus or embolus may lodge there. Atsatt[1] reports a case of acute osteomyelitis of a vertebral body following a compression fracture. Kulowski[9] found a history of trauma in 8 cases of osteomyelitis in a series of 60 reported cases. It is at least suggestive that some type of mild trauma aided the establishment of an area of infection in the spine.

No etiologic agent could be identified in this series. Tuberculin and histoplasmin skin tests, blood cultures, and agglutinations for typhoid, paratyphoid and brucellosis were entirely negative.

Evaluation of the results of treatment are somewhat difficult. Certainly conservative orthopedic measures of immobilization with body casts and back braces prevented spinal deformity, and one year after the

onset, all cases were symptom-free. Case 11 apparently benefited from penicillin therapy but Case 1 showed no change in the febrile course after receiving 6,600,000 units of penicillin. The other 2 cases received no chemotherapy or antibiotics.

These cases were obviously not tuberculosis and they were not typical osteomyelitis of the spine. In adults Ghormley, Bickel and Dickson[7] described an analogous syndrome which they called "acute infectious lesions of the intervertebral discs." Clinical signs of infection were mild or consisted of severe backache for one or two weeks and spasm and tenderness over the affected area of the spine. The characteristic changes were those found by roentgen examination. In the acute stage no changes were seen. On careful study diminution in the width of the intervertebral space occurred later. The narrowing remained for several months, and then bony proliferation along the margins of the involved vertebrae began. In some of the cases bony fusion occurred. In several cases there was paravertebral soft tissue thickening. If vertebral involvement was extensive they felt that a diagnosis of osteomyelitis could be made; but if only minimal changes were observed, they felt that the lesion was not a true osteomyelitis. All patients showed a satisfactory recovery.

Smith,[11] in 1933, described a similar group of cases, mostly in adults, of a benign form of osteomyelitis of the spine. Many of these cases had been confused with tuberculosis of the spine. Clinically there was mild backache and low grade fever. The diseased area tended to be chiefly in the mid-lumbar or mid-dorsal spines. In most cases there was a history of infection elsewhere in the body preceding or following the spinal infection. The important roentgen changes were thinning of the intervertebral disc only—2 cases; thinning of the disc with partial destruction of vertebral bodies—5 cases; partial destruction of vertebral bodies with bony ankylosis—6 cases; partial destruction of vertebral bodies with probably bony ankylosis—4 cases; and destructive lesions of the posterior arches—3 cases.

Weens[12] described 6 cases of spinal lesions in children showing calcification of the intervertebral discs. All were characterized by an acute episode of localized spinal pain, limitation of motion and spinal deformity. In 4 of the cases the lesions occurred in the cervical spine. Rapid change in the size of the calcifications and complete disappearance of the calcifications occurred in 5 of the 6 cases. There was no evidence of narrowing of the intervertebral spaces or of vertebral involvement in any of these cases. All children recovered completely.

In his report of 48 cases of pyogenic osteomyelitis of the spine, Guri[8] discusses the differential diagnosis of pyogenic osteomyelitis and tuberculous spondylitis. As in this present series of cases, he found that in pyogenic spondylitis of the localized type the changes as seen by roentgenograms occur far more rapidly than in tuberculosis both in regard to the destructive and reparative processes. Also vertebral sclerosis occurring within one or two months was very unusual in tuberculosis although it was common in pyogenic infections.

Due to the proteolytic enzymes formed by pyogenic exudates, rapid, early involvement of the intervertebral disc and also of the vertebral bodies is seen far more commonly with pyogenic infections of the vertebrae than in tuberculosis. Phemister studied the changes of cartilage incubated in pyogenic and tuberculous pus at a temperature of 55° C. for several days so that bacterial action was suspended and proteolytic action was augmented. He found that the cartilage suspended in pyogenic material was completely digested in several hours whereas cartilage suspended in tuberculous pus showed no evidence of digestion after several days.

The one case occurring in a boy of fourteen was included in this series since it demonstrates the relationship in the clinical behavior of spondylarthritis as compared to acute osteomyelitis and the difference between this syndrome and epiphysitis

of the spine (Scheuermann's disease). This case is quite similar to those cases of subacute osteomyelitis reported by Guri and Smith. There was a relatively satisfactory restoration to a normal appearance of the vertebrae after one year but the narrowing of the intervertebral space persisted. This persistent narrowing is probably due to the vascular supply of the intervertebral disc and is discussed below. The lesions of epiphysitis of the spine have a much different course both in our experience and as described in an excellent survey by Nathan and Kuhns.[10] They studied 75 cases and noted faulty posture in all. In all but 3 of their cases a large number of vertebrae were involved. Roentgen changes were confined to the vertebral bodies with irregular epiphyseal fragmentation, slowly progressing wedging of the vertebral bodies, Schmorl's nodes and later involvement of the intervertebral discs. In this case the changes in the intervertebral disc preceded the sclerosis of the vertebral bodies. Sclerosis of the vertebral bodies is not found in epiphysitis of the spine, especially in the early stages.

Ferguson,[6] in discussing wedging round back, states that the presence or absence of changes in the intervertebral discs is incidental and not essential for diagnosis. He feels that in this lesion the changes can be traced from early infancy although the findings become noticeable only at adolescence. In spondylarthritis the changes in the intervertebral disc form an early and important part of the syndrome. Epiphysitis of the spine tends to be a slowly progressive disease occurring over several years, whereas the changes of spondylarthritis take place in a far shorter time interval. There is also in this syndrome a definite partial restoration to a normal appearance of the vertebral body while in epiphysitis in time the lesion becomes only stationary. Banks, Krigsten and Compere[2] report 5 cases of infections involving epiphyseal centers of ossification showing that further growth and development can occur if the cartilaginous portion of the epiphysis is not entirely destroyed.

The most important characteristics of this syndrome are the roentgenological changes. There is narrowing of the intervertebral space about two to four weeks after the onset of the clinical symptoms, with some demineralization or destruction of part of the vertebra. The narrowing of the interspace persists for four to twelve weeks and beginning sclerosis of the vertebral body is seen. During the next two to eight months there is gradual widening of the intervertebral space with sclerosis and new bone formation in the areas of destruction. In very young children there is a remarkable restitution to a near normal appearance within one year, whereas in tuberculosis similar changes occur at best only over a period of two or three years. In spite of this fact, the 3 cases in the younger children were at some time during the clinical course diagnosed as tuberculosis.

The differences in the roentgen changes in this syndrome and those described above are probably due to several factors. In the embryo and very young child, the intervertebral disc receives an excellent blood supply from the surfaces of the vertebral bodies.[4] Vessels derived from the periosteum, axial vessels paralleling the original notochord and vessels coming from the central portion of the vertebral body penetrate the disc forming anastomosing arcades. These vessels are well seen in the embryo. Regression and scarring of these vessels begins shortly after birth and progresses slowly to completeness by the age of eighteen to twenty-five years. At times some of these vessels penetrate the annulus fibrosus to reach the nucleus pulposus but usually the nucleus pulposus does not receive a direct blood supply. In a young individual these vessels are open to the general circulation. It may well be that the mild trauma in 3 of these cases permitted a low grade infection to become established. In the cases of calcification of the intervertebral disc in childhood Weens felt that the eventual disappearance of calcification was due to the excellent circulation of the intervertebral disc and a similar conclusion is likely in this series. In the fourteen year

old boy restoration of the intervertebral disc was relatively poor since the blood supply to the disc was impaired in part because of his age.

CONCLUSIONS

1. Spondylarthritis in children is characterized by the roentgenological picture of narrowing of the intervertebral space and evidence of mild destruction of the adjacent portions of the involved vertebrae which are slowly progressive for one to two months and then show evidence of healing for two to eight months with relatively complete restoration to a normal appearance.

2. It is important that this syndrome be differentiated from tuberculous spondylitis. This differentiation must be made from a study of serial roentgenograms as well as by clinical findings.

3. A specific etiological agent could not be demonstrated. Trauma and low grade infection appear to be causative factors in part.

4. The "hip joint syndrome" due to disease of the lumbar spine should be considered in all cases of symptoms referable to the hip joint in which an obvious lesion is not found.

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DISCUSSION

Dr. Ralph S. Bromer, Bryn Mawr, Penna. I think Dr. Saenger is to be congratulated on bringing this lesion to our attention. As it is of rare occurrence, our experience has been limited. In searching the literature, I found that the paper of Guri, quoted by Dr. Saenger in his paper, is well worth quoting. Guri divided the onset and course of the disease into four syndromes: (1) the hip joint syndrome, emphasized by Dr. Saenger, (2) the abdominal syndrome, (2) the meningdal syndrome and (4) the backpain syndrome. He divided the last group into the acute form, the subacute osteomyelitis type and the type with an insidious onset, as described by Dr. Saenger. One of the most constant findings in the last group was limitation of motion of the affected portion of the spine and detection, at times, either by palpation or percussion of an area of localized tenderness.

In some of the cases reported in the literature positive blood cultures of pyogenic organisms have been found which was not the case in Dr. Saenger's series. Abscess formation has been reported, likewise rise in the leukocyte count and increase in the sedimentation rate. In such instances the diagnosis is made more easily.

In regard to the differentiation from tuberculous arthritis of the spine, the degree of density of the bone reaction, as an argument against tuberculosis, cannot be relied upon in every case. Again quoting Guri, he believes that areas of increased density in tuberculous in-

volvement are not frequently found in roentgenograms of living subjects with the exception of patients with secondary infection, huge sequestra, or sudden collapse of the bodies of the vertebrae. Areas of increased density are also sometimes seen in children during the early stages of the disease or during the healing period.

Dr. Saenger's paper is timely and important in that it may prevent, in the future, mistaken diagnoses of tuberculous arthritis or osteochondrosis of the spine in the insidious type of case.

Dr. E. B. D. Neuhauser, Boston, Mass. This is in no sense a series of ex cathedra statements, but I would like to think out loud for a moment on this subject. I doubt very much if this condition is uncommon as Dr. Bromer has suggested. I think it is probably a fairly frequent entity and again one that we keep overlooking. We have seen a good many at The Children's Hospital.

I would like to propound a hypothetical question, although I do not expect anyone to answer it. I would like to question how many entities we are dealing with in this roentgen picture that has been shown here. Perhaps one can draw an analogy between the lesions that Dr. Saenger has shown and coxa plana or osteochondrosis of the hip. It is an area that is much better understood, perhaps because we know the anatomy better.

Here one may have a series of roentgen changes that cannot always be distinguished from bone destruction. These changes may be initiated by a great many different factors. It is possible to have a primary inflammatory process in the synovia of the hip joint, which may diminish the blood supply of the head and neck leading to the characteristic train of changes that we call coxa plana. Again it is possible to have a similar roentgen picture produced by infiltration of abnormal cells in the neck, such as in Gaucher's disease. As far as the changes in the head go, it is quite impossible to distinguish one from the other. Perhaps the best example is the identical coxa plana picture that may be produced during treatment of congenital dislocation of the hip. When a hip is put up in plaster in the frogleg position tension applied to the retinaculum of Weitbrecht again produces diminution in the blood supply with a resulting identical roentgen picture, and I wonder whether the same thing is true in the spine. It does seem possible that we are dealing with a roentgen picture similar in each instance but produced by a variety of mechanisms.

I think Dr. Saenger certainly is to be congratulated on this interesting and concise presentation, and I am sure that the answers to this problem will come.

Dr. B. J. Harrison, Vancouver, B. C. I, too, think that Dr. Saenger is to be sincerely congratulated on bringing this condition to our attention, but like the previous speaker I am not satisfied that it is so uncommon. I think we see cases of this type not only in the young but later on in life as well, and in investigating the origin of these, I came across a situation that occurred in the South of France, more markedly since World War II but present also before the war.

When the wave of brucellosis infection from the Isle of Malta passed across the Mediterranean and up across the South of France, it was found that changes very similar to this occurred in the spines of patients following on the wave of infection, so that despite the negative test for brucellosis in these cases I am inclined to think that they must be considered from that point of view.

The outstanding characteristics of the changes in the spine due to brucellosis are often identical with these. The change in the spine has been described as one which resembles tuberculosis fairly accurately, but which evolutes at a rate per week comparable to that at which tuberculosis evolutes per month. I think further consideration of the possible infectious nature of this condition should be continued.

Dr. Merrill C. Sosman, Boston, Mass. I am sure that this condition or reaction is a single disease. I say that because we had an epidemic of several cases of progressive narrowing of the intervertebral disc with slight destruction of the adjacent vertebral plates followed by new bone formations and we got it all from a hospital near the Peter Bent Brigham.

In running down this epidemic, considering brucellosis and other conditions as Dr. Harrison suggests, we found that the only common denominator was that all of them had had a lumbar puncture by the same energetic physician. I think what happened was that the needle had gone a little too far through the spine, through the opposite subarachnoid space and into the disc. Add to that the fact that their sterilizing apparatus was not functioning properly and a low grade spore-forming organism which was undoubtedly transmitted to the intervertebral disc, and the epidemic was solved.

I would like to ask Dr. Saenger if any of these patients had had a lumbar puncture within a few weeks or months preceding the appearance of the symptoms?

Dr. Saenger (closing). In regard to the possible etiology of these lesions and also of other diseases which we see in children, there is one problem which has certainly confused us at our hospitals. In some of these cases, the patients have received small doses of penicillin or one of the sulfonamides several days before admission. We have often wondered whether the small doses of these very powerful drugs do not attenuate the organisms which we might otherwise find by blood culture or agglutination studies. We certainly have not made any exhaustive study of these patients for brucellosis, and some of them have come from rural areas.

The question of how many entities this paper represents I will leave to those investigators in the future who may pursue this problem further. There is one thing about which Dr. Bromer has asked me to comment and that is the rarity of this type of lesion. He still maintains that it is rare. I cannot maintain as yet that it is common but certainly agree that there are many cases of lesions similar to those I have presented which we are overlooking. Furthermore, I do not call this type of lesion a specific entity but only a syndrome.

In answer to Dr. Sosman's question, none of these patients had had a lumbar puncture before being admitted.

ON THE RELIABILITY OF ROENTGEN SURVEY PROCEDURES*

By L. H. GARLAND, M.D.†
SAN FRANCISCO, CALIFORNIA

"When we mean to build
We first *survey* the plot, then draw the model;
And when we see the figure of the house,
Then must we rate the cost of the erection."
King Henry IV, II, Act 1, Sc. 3.

ROENTGEN survey procedures are medical programs designed for the mass detection of disease in apparently well persons. They are of numerous types: chest surveys for the detection of shadows suggestive of pulmonary tuberculosis; chest surveys for early silicosis, pulmonary cancer, or cardiovascular disease; gastric surveys for the detection of silent stomach tumors; pre-employment lumbosacral spine surveys for evidence of past injury or anomaly; and so forth. The present paper deals only with the first of these types, the roentgen survey for tuberculosis.

Everyone is agreed that the control of tuberculosis is desirable. To control it at the present time, we must find it, and to find it we must do mass skin tests, or sputum surveys, or chest roentgenograms. However, it is essential that the survey be regarded not as an end in itself, but merely as a part of an integrated tuberculosis control program. To find persons with abnormal roentgen shadows is of little value, unless there are available effective arrangements for completion of diagnosis and treatment. A properly integrated tuberculosis control program has been defined by the World Health Organization as one consisting of the following five elements, *no one of which is effective alone:*

1. Prevention
2. Case Finding
3. Isolation and medical care
4. Rehabilitation and after care
5. Social and economic protection of the afflicted family.

Reports of roentgen survey procedures usually list the number of cases found to have abnormal shadows of any type, shadows due to obsolete or active disease, anomaly, injury, and so forth. Most reports fail to indicate clearly the precise number of these verified bacteriologically or by adequate serial follow up. The roentgen interpretation is often regarded as decisive, and selected checks on apparent negatives are not recorded.

How should one test the reliability and effectiveness of a given survey? It can scarcely be done by local morbidity or mortality figures. Indeed, there is ample evidence that the encouraging decline in tuberculosis in the United States during the last half century is just as great in areas lacking mass surveys as in those in which they have been conducted. A mass survey does not of itself take care of or reduce the incidence of tuberculosis. We believe that a reliability test should include careful integration of clinical and bacteriological studies on *all* positives detected (*i.e.* all persons reported to have abnormal roentgen shadows suggestive or indicative of inflammatory disease), plus careful review of *all* reported negatives by a panel of tested roentgen film readers (*i.e.* a review of films of all persons reported as showing no roentgen evidence of significant pulmonary disease). Perhaps the ideal reliability test would be one in which all reported "negatives" were required to have bacilli tests! Despite the vast sums expended on tuberculosis surveys to date, such elementary but obviously essential tests have not yet been reported on any mass survey. Even in Minneapolis, the health authorities now speak of their city-wide fast-tempo mass survey "in terms of case-finding

* Read by invitation at the Annual Meeting of the San Francisco County Medical Society, December 13, 1949.
† Clinical Professor of Radiology, Stanford University Medical School.

potentialities rather than case-finding results."[7]

However, there is one facet of the survey problem on which we do have fairly extensive and reliable data, and that is the matter of roentgen interpretation, considered as an isolated entity and not correlated with sputum or other studies. On this one phase we would like to summarize existing results, and in so doing, again emphasize that the many other phases are equally in need of critical testing and evaluation, especially by the agencies sponsoring or advocating surveys.

EARLY ROENTGEN INTERPRETATION STUDIES

In 1944, studies were made to test the diagnostic value of the different roentgen recording media then used in mass surveys of the chest.[3] The results were subjected to statistical study, and it was found that not one of the various film methods was superior for *case-finding* purposes to any of the other methods. In the process of analyzing the results of 4 sets of roentgen records made on each of 1,256 persons, it was observed that there was a significant percentage of over- and under-reading. That is, films read by a majority of readers as negative (and apparently negative by all known criteria) were read as possitive by some readers—*over-reading or false positives*. Conversely, some films accepted as positive by a majority, *i.e.*, as showing roentgen evidence of disease, were read as negative by other readers—*under-reading or misses*. Further, the same reader was inconsistent with himself in a surprising number of instances, on both scores, when the same films were read on two separate occasions.

These errors were carefully studied by various methods. For one, they were measured by a study of the relative frequency with which a reader was inconsistent with other readers (*inter*-individual variation) and with himself on two separate readings of the same set of films (*intra*-individual variation).

The degree of *inter*-individual variation, based only on the positives and *not* on all cases read, was from 5 to 24 per cent. (Variation can be measured in different ways. As an example, if in a set of 100 films there are 4 positive and 96 negative, and a reader selects 2 of the positive and calls the remaining 98 negative, he might be regarded, by one standard, as being only 2 per cent wrong or inconsistent. On the other hand, if the set of films consists of survey material, the object of which is to detect all the positives, he might be regarded as 50 per cent wrong. In the percentages recorded in these paragraphs, the second criterion is being used.) The degree of *intra*-individual or personal variation was from 3 to 31 per cent. Of 1,256 14 by 17 inch chest roentgenograms interpreted by 5 different physicians, the range in number of positives reported was 56 to 100. These were not all the same cases: the total number reported as positive on one or more readings was 131.

ROENTGEN INTERPRETATION RESEARCH PROGRAM

Three outstanding radiologists were appointed as a special committee by the Tuberculosis Control Division of the United States Public Health Service to investigate this unexpected problem of wide individual variation in reading survey films (Dr. W. E. Chamberlain, Dr. L. G. Rigler and Dr. R. R. Newell). They read, and re-read many times, various prepared sets of survey films; they classified and described the shadows on those and other sets of films, testing themselves and each other in different ways for a period of two years. They decided that the degree of variation was as great as previously noted. They considered its solution baffling, and thought that additional approaches to it should be essayed. They suggested that a sound descriptive terminology would be an important starting point.*

At this stage, we were invited to form

* A report on this important work is now being completed by Newell, R. R., and Yerushalmy, J.

an associate research committee (with members chosen on a geographic basis in order to permit more frequent study conferences). Accordingly we sought and secured the cooperation of Dr. Earl Miller (Associate Professor of Radiology at the University of California) and Dr. H. Zwerling (a well known radiologist who had made extensive tuberculosis roentgen survey studies in the United States Public Health Service for several years). We were guided in our statistical analyses by Dr. J. Yerushalmy (Professor of Biostatistics at the University of California).

TABLE I

EVALUATION OF CONSISTENCY IN "SEEING A LESION"

Number and Percentage of Disagreements between Readers (Inter-individual) and for Different Interpretations by the Same Reader (Intra-individual) on 399 Films Interpreted Twice by Each of Three Readers

	Inter-individual Comparison	Intra-individual Comparison
Number of films	399	399
Number of pairs of readings on each film	12	3
Total number of pairs of readings—all films	4,788	1,197
Number of pairs of readings essentially in agreement	4,015	1,101
Pairs of readings in complete disagreement: Number	773	96
Per cent	16.2	8.0

Prior to developing and testing a suitable terminology, we read and re-read a group of 399 films several times. Again the disconcerting happened: a 16 per cent inter-individual and an 8 per cent intra-individual disagreement as to presence or absence of a lesion (see Table 1).

The film interpretations were then studied as to lesions missed. A film was regarded as positive if read as such 4 out of 6 times by all three readers. The percentage of missed lesions was 7 per cent; however, if films regarded as questionably positive were included (*i.e.*, three out of six readers read as such) then the percentage error reached 13 per cent.

The reasons for missing positives were studied extensively; they appeared to include the following: location, density and type of infiltrate, and quality of film.

1. Location: the lesion may be hidden by or merged with a rib or heart shadow;
2. Density: the lesion of faint or small type may be overlooked;
3. Type: a slender infiltrate may resemble a blood vessel or artefact;
4. Quality of film: poor focus; low contrast; poor processing; extraneous shadows, etc., cause difficulties.

The *attitude* of the reader was tested in a set of 225 films read twice with two different attitudes. It was found that a "pessimistic" attitude on the part of the readers resulted in an average of 10 per cent under-reading or misses in the samples surveyed, while an "optimistic" attitude gave 15.3 per cent misses. This "attitude" factor must therefore be considered in the analysis of reasons for misses.[10]

With the various sets of films which we read and re-read, we had a general incidence of over-reading varying from 4.7 to 12 per cent. Subsequent studies have indicated that this figure is artificially high and apparently due largely to the particular nature of the samples we were given. In regular survey work, the incidence of "positive" films is only about 1 or 2 per cent; one would therefore need several thousand such films in order to provide enough positives to permit valid conclusions based on positive cases. Our material in 1947 and 1948 turned out to contain from 20–30 per cent positives; it was apparently of a type sufficiently different from average routine survey sets to result

in exaggeration of the degree of over-reading.* This figure for over-reading is now believed to be in the 1–3 per cent range for experienced interpreters reading ordinary survey material.

The results of our attempts at description of lesions have been published[10] and do not need repetition here.

ADDITIONAL STUDIES

Following the above work, we were privileged to take part in a study of 1,807 minifilms made as part of an unselected mass survey in Berkeley, California, this year. We read each of these films, in conjunction with three radiological colleagues and two chest specialists; 10 complete sets of readings (or 18,070 reports) were available for statistical analysis. The results of this work will appear shortly in a paper by Yerushalmy *et al.* in the *American Review of Tuberculosis.*†

The range of individual variation in reported positives was 32 to 83 cases. The total number of cases called positive on one or more readings was 254! The number finally agreed upon by the entire group of readers as definitely positive (i.e., follow-up essential, based on the roentgen findings) was 30 (see Table II).

TABLE II

INDIVIDUAL VARIATION IN FILM INTERPRETATION

1,807 Minifilms (70 mm.)

Reader	1st Reading	2nd Reading
A	58	74
B	38	32
C	48	56
D	83	57
E	51	—
F	80	—

Range 32–83. Total No. called positive on one or more readings 254

Under-reading (*i.e.*, of the 30 films all agreed were positive for shadows requiring follow up) varied from 26.7 per cent to 43.4 per cent. The average was 32.2 per cent. It decreased with experienced trained readers. Over-reading (*i.e.*, calling films positive, when a majority opinion on said films was that they were in fact negative) varied from 0.9 per cent to 2.7 per cent. It averaged 1.7 per cent.

TABLE III

INCONSISTENCIES ("ERRORS") IN INTERPRETATION

Mass survey of 1,807 persons, 70 mm. minifilms

2 readers reported	1,714 negative
2 readers reported	24 positive
2 readers reported	69 differently (disagreement)
1,714+24=1,738 or 96% agreement (1,738/1,807)	
But of 24 positives and 69 potential positives (93 cases) there was only 26% agreement (24/93)	

All readers agreed on 30 films as being positive for shadows which should be followed:	
Tested readers with radiological training detected	22 (73%)
Tested readers with other training detected	17 (57%)

Less thoroughly trained readers missed more positives than more thoroughly trained ones by a factor of 62 per cent (*i.e.*, in the entire 1,807 consecutive survey films there were 30 positive films; 8 of these were missed by very experienced readers and 13 by less experienced). How much worse would the results be with the average run of mass survey readers who, despite much volume, have had little critical training?

DISCUSSION

Before assuming that this factor of error in minifilm surveys is unique, let us consider the facts disclosed by other types of survey.

1. *Pediatric Survey.* A group of five experienced pediatricians was asked to classify 221 children according to their nutritional status. They made complete clinical examinations and employed all

* Our samples were, of course, picked without any knowledge on the part of the prospective readers. They were prepared by a team composed of an independent well trained radiologist and a statistician. This team revised the identification numbers on all films prior to each set of readings.

† *Am. Rev. Tuberc.*, April, 1950, *61*, 443.

such diagnostic aids as they desired. In the entire survey, the number of children reported by the different pediatricians as suffering from malnutrition varied from 32 to 47; further, these were *not* the same cases! There were 90 (41 per cent) in which one or other examiner diagnosed malnutrition. There were only 7 (3 per cent) in which all five examiners agreed.*

2. *Tonsillar Disease Survey.* The American Child Health Association conducted a study of 1,000 eleven year old school children.[1] Of these, about 611 had had their tonsils removed. The remaining 389 were then examined by physicians, who selected 174 for tonsillectomy and rejected the rest. This left 215 children whose tonsils were apparently all right. Then, however, another group of doctors was put to work examining these 215 children. This time 99 were adjudged to be in need of tonsillectomy. So still another group of doctors was employed to examine the remaining children and nearly one-half of these were selected for operation. In the end, only 65 of 1,000 children remained whose tonsils had not been either removed or recommended for removal. Had these 65 been examined by a still another group of physicians the number might have been reduced still further, but at this stage the investigation was concluded.

"The study showed," says Bakwin, "that there was no correlation whatsoever between the estimate of one physician and that of another regarding the advisability of tonsillectomy, and the authors therefore concluded that the chance of a child being recommended for operation depended principally on the physician rather than on the child's health status."

3. *Clinical Laboratory Survey.* Clinical laboratory procedures are analogous to radiological studies in that single results are often accepted at face value and accorded decisive import. It is therefore instructive to review a critical analysis by Belk and Sunderman.[2]

TABLE IV

AN EVALUATION OF CLINICAL LABORATORY PROCEDURES SHOWING VARIATIONS IN THE RESULTS OF CHEMICAL ANALYSES OF STANDARD SOLUTIONS IN DIFFERENT LABORATORIES

Substance Tested	Concentration, as Prepared, per 100 ml.	Range of Actual Results	Per Cent of Determinations Classified as Satisfactory, Unsatisfactory and Gross Error		
			Satisfactory	Unsatisfactory	Gross Error
			per cent	per cent	per cent
Hemoglobin	8.9 gm.	8.0– 15.5 gm.	33	67	22
Glucose	60 mg.	40 –570 mg.	63	37	10
Sodium chloride	465 mg.	350 –775 mg.	68	32	5
Total protein	6.6 gm.	4.7– 12 gm.	38	62	15
Calcium	6.6 mg.	3 – 18 mg.	33	67	28

From Table 1. Belk and Sunderman.[2]

A number of carefully prepared solutions were distributed among 59 different hospital clinical laboratories for analysis. The results showed enormous variation in the reports. For instance, one sample of hemoglobin was prepared to contain 9.8 gm. per 100 cc. The reports gave a range of 8.0 to 15.5 gm. Fully 67 per cent of the reports were regarded as beyond the reasonable range of error. Similar results may be noted for the other solutions.

The above observations give a clue as to the frequency and magnitude of error in various fields which have been measured. The student must conclude that it is highly probable that a similar degree of imperfection exists in many fields. Most radiol-

* Derryberry, M. *Pub. Health Rep.*, 1938, *53*, 263.

ogists and chest physicians are incredulous of such results as ours—until they have actually subjected themselves to a valid statistical test.

Calkins[4] recently observed that "many of our accepted facts of to-day are based on the study of an extremely small number of patients." For example, until recent years, the standard accepted pelvic measurements in females were based on a study of only 50 women. When Caldwell and others[8] measured a large number of women, the average measurements proved to be smaller than formerly believed. Experienced investigators accept statements published in textbooks with reservations. They are often only abstracts from prior texts and not necessarily statistically proved facts.

COMMENT

A survey minifilm is a reduced-size photograph of the roentgenoscopic image of an adult chest. A tuberculous infiltrate is a disease process of variable size, potentially of microscopic dimensions in early cases. The wonder is, therefore, not that some cases are missed in mass surveys but that so many are apparently found. Nevertheless the fact is that lesions both small and large *are* missed, some even with cavitation. Why is this? First, one is working with a single two-dimensional shadowgraph; second, one is dealing with the factors mentioned previously (concealed or small lesions; films of poor quality; reader fatigue and "the human equation").

Can this be said of regular roentgen examination? No, not if it is properly performed.[6] Regular roentgen examination of the chest consists of posteroanterior and lateral films, plus roentgenoscopy or such other procedures as the *individual* case requires in the judgment of the examining radiologist. Stereo posteroanterior views; oblique projections; posterior lordotic views; heavy density studies, or films made in various phases of respiration may be required for the demonstration of the lesion. One does not rely on a single film in examining the alimentary or urinary tracts: one should not do so in the respiratory tract.

The reliability of regular roentgen examination of the chest (as defined above) is reported to be of high degree.[6] With this we concur. The reliability of carefully performed roentgen surveys also is high, but there is a degree of error which has been shown to be significant—from 13 to 27 per cent in experienced hands, and much larger (up to 46 per cent) in less experienced. This error has to be personally experienced to be appreciated. Practically every radiologist who first read our results said "This could not happen to me; there must be some mistake." But those who tested themselves soon found that the problem is a very real one.[10]

The degree of survey error can be reduced by several methods, notably the following:

1. Careful selection of the panel of readers.
2. Use of valid tests for readers prior to appointment.
3. Use of dual readings.
4. Constant expert supervision of film quality.
5. Avoidance of reader fatigue and eye strain.

Dual readings were tested in the 1,807 minifilm survey. It was found that such second reading resulted in detection of 34 per cent of the positive films missed by a single reading. So long as the two sets of readings were done independently, it seemed to matter little whether the second reading was performed by the same or by a different reader. However, by either method the number of false positives reported almost doubled: this disadvantage is presumably outweighed by the gain in positives.[14,15]

ADDITIONAL COMMENTS

The true reliability of roentgen surveys is influenced by many factors, notably the element of self-selection prior or subsequent

to making the survey films. Even with the most strenuous of efforts, it is rarely possible to persuade more than 80 per cent of any large population-group to have minifilms. It may be that in the remaining 20 per cent there is a higher incidence of silent or concealed active disease.

Second, in the group that does consent to minifilms and are found "positive" (that is, bearing shadows of potential significance), only one-half to two-thirds will report for subsequent examination, including large films, sputum tests and clinical studies.

Finally, in the group that does cooperate until completion of diagnosis and discovery of bacilli, about one-third refuse or soon discontinue hospitalization and isolation.

GENERAL SURVEY RESULTS

The incidence of clinically significant pulmonary tuberculosis varies with the age, sex, race and economic level of the population group surveyed.[5,12] In many surveys, the so-called active cases are labeled as such on film findings alone, and are often grouped as minimal (45 per cent of cases); moderate (40 per cent) and far advanced (15 per cent). However, the diagnosis of activity requires bacteriological and clinical verification;[9] proved active cases are usually less than 0.1 per cent of the persons surveyed.

The results of current surveys in one large city on the West Coast are summarized in Table v. This shows that the average yield in the white adults surveyed was 2 cases of active pulmonary tuberculosis per 1,000 persons roentgenographed. Bush, in a personal communication, regards the figure for most Northern California communities as closer to 1 per 1,000 (one sputum positive case).

TABLE V

AVERAGE LARGE SURVEY YIELD

(White Adults S.F.)

Minifilm cases		1,000
Recalled (retakes or large films)		65
Roentgen findings: Negative	35	
Tuberculosis suspect	16	
Cardiac suspect	7	
Other findings	7	
(Final tuberculosis diagnosis:		
Inactive		11
Questionable		3
Active		2)

Other observers have estimated the yield to vary as follows: In the United States Army inductees 7 active cases per 1,000 surveyed (Levitin). In New York City homeless persons 52 per 1,000, and in New York City prison inmates 59 per 1,000 (Robbins and Ehrlich). However, none of these groups is fully sputum verified. It can be stated that most mass surveys have a yield of 1.3 per cent "active or inactive pulmonary lesions by roentgen ray" and that bacteriological proof of activity is found in 0.1 to 0.4 per cent.

The yield in 4 recently surveyed United States cities (Public Health Service fast tempo) is reported as follows:

	Number of Persons Surveyed	Per Cent of Cases of "Susp. of Definite Tbc." by Minifilm	Incidence by 14″×17″
Minneapolis	301,513	2.0	1.3
Seattle	375,952	2.2	1.1
Tacoma	72,703	0.9	0.7
Washington, D. C.	440,491	2.4	1.5

TYPES OF MASS SURVEYS

There are some variants of the mass survey and some mutations thereof which may be worthy of brief consideration; some of these fall just short of being chest diagnostic examinations.

1. Mass surveys of the unselected population—apparently well persons— for early or silent communicable disease. This is a Public Health measure of general interest: it is economic when conducted with efficient personnel, proper arrangements for follow up, and adequate measures for handling discovered cases of communicable disease. It may be done by

a. Locally developed teams on a continuous survey basis, and at tempo geared

to local facilities for completion of diagnosis and treatment; or

b. Nationally developed teams on a single survey basis, at fast tempo, usually quite out of gear with local facilities.

2. Mass surveys of governmental employees, civil and military; an official health program to reduce sickness and compensation costs.

3. Mass surveys of private industry. With the exception of initial or educational demonstrations, these surveys are properly the field of private medical practice.

4. Mass surveys in large institutions wherein persons are housed in propinquity, thereby constituting an increased health hazard—large general hospitals, sanatoria, mental, penal, custodial and other such institutions.

5. So-called "mass surveys" of selected individuals who have contacted a physician or sought private employment. These are really private, diagnostic roentgen-ray screenings, and not random surveys. The yield is exceedingly small, and the complications numerous. Not the least of the latter is the tendency for this type of so-called survey to be done ostensibly "without charge" by local welfare associations. This results in *education of private patients to accept medical services for nothing*—a precedent of dubious wisdom.

These remarks apply to continuation surveys, not to an initial or educational survey. For the latter, which has been often pioneered by the local Tuberculosis Association, that organization deserves great credit.

The quality of local surveys has varied greatly from one community to another. In some, the survey is well planned, thoroughly administered, and well followed; in others, the survey or case finding project appears to be made an end in itself, with little or no real attempt at follow-up or isolation of the positives. One County Association in this State has a reading panel of qualified radiologists, another a panel of radiologists and chest specialists; however, one State division had a film reading panel last year composed of 16 "chest men" and only 1 trained radiologist.

COMPLICATIONS AND SIDE EFFECTS

The complications of mass surveys include:

1. Alarm, and even loss of employment or insurability, as a result of false positive reports of pulmonary tuberculosis. It takes many months, especially in official circles, to negate a false positive.

2. Alarm and hypochondriasis induced by erroneous reports of "cardiac abnormality."*

3. A false sense of security from a reported "negative" examination. "Even with mass roentgenography of the supposedly healthy population, pulmonary tuberculosis is not diagnosed early enough."†

4. Indifference on the part of many "positives." In Erie County, Pennsylvania, seven months after a mass survey of over 100,000 persons, only 25 per cent of the 1,211 cases notified regarding positive roentgen shadows had been contacted and followed, and in this group only 55 sputum tests were made. The rest may well have felt "tbc. is not such a serious disease."‡

5. Exposure of private individuals' names to clerks and others in local Public Health and Welfare Agencies concerned with the follow-up of those showing suspected shadows.

6. Expense of confirming "non-activity" in persons reported erroneously to have shadows due to "active" disease.

FUNDAMENTALS IN ROENTGEN SURVEY PROCEDURES

We believe that fundamental to the success of tuberculosis control, and therefore to success in roentgen surveys, is adequate *care for the known, active cases first.* It is more than foolish to spend public and private funds and energies on the detection of new cases without first taking

* See *Bull. San Francisco Co. Med. Soc.*, Jan. and Feb. 1949, *22*.

† McLean, A. *Edinburgh, M. J.*, 1947, *54*, 488; see also ref. 11.

‡ Bacon, R. *Pennsylvania M. J.*, 1947, *51*, 141.

care of the known open cases now walking the streets for lack of personal interest in completing treatment, or lack of nursing help, or beds, or of regulations requiring reasonable isolation of open communicable cases.[13]

Having controlled a majority of the known active cases, then the survey should be commenced by

1. *Making adequate arrangements in advance* for the *follow-up* and completion of diagnosis on persons found to have suspected minifilm shadows: this requires sputum tests, clinical examination, etc., and

2. Making *adequate arrangements for handling the questionables:* economic methods for recheck at suitable intervals of persons with positive roentgenograms but negative tubercle bacilli tests; skilled personnel to explain the limitations of all existing diagnostic tests, without encouraging fear or indifference on the part of these citizens.

After such arrangements are completed, then the *survey staff personnel* (technical and professional) should be chosen, the readers preferably from a tested panel. The population to be surveyed ought to be decided on (commencing with high yield groups). Finally, the apparatus to be used should be selected, and the survey (with dual readings) begun.

The need for tested readers is shown in Table VI.

TABLE VI

TO ILLUSTRATE THE NEED FOR TESTED READERS IN MASS SURVEYS

We bother	100,000 persons
to pick up approx. active (sputum positive) cases	100 cases
With expert, tested readers one may expect to miss	27 cases
With medium trained readers	46 cases
With poorly trained readers	? cases

SUMMARY

1. Roentgen surveys are medical diagnostic procedures. They are of various types—mass surveys, educational surveys, pre-employment screenings, regular medical examination screening, etc.

2. The reliability of surveys may be measured in various ways. Such tests require careful recheck of all films made, plus adequate statistical study. They should disclose the percentage of "positives" detected, and of "negatives" correctly identified.

3. Using film records of medium quality, experienced readers and single readings, the reliability of one survey was found to be of an order of 73 per cent as far as positive films were concerned.

4. The reliability and effectiveness of surveys appear to depend upon several factors: (a) the quality of the records, (b) the competence and interest of the interpreters, (c) the use of dual readings and (d) the adequacy of follow-up (clerical, clinical and bacteriological). Skilled technicians and tested physician-interpreters appear to be essential for high reliability.

5. Surveys of unselected groups of apparently well persons for the detection of communicable disease are excellent medical measures, of sound public value, especially when made in groups with high yield. The American Tuberculosis Association is to be congratulated for its assistance with properly conducted educational or initial demonstration surveys.

6. The discovery of new cases of tuberculosis is useful only if the discovery results in effective action. It is scarcely economical to hunt for new cases, and allow the already known ones to go without control.*

7. There is evidence to indicate that the gradual, continuous local survey, with proper follow-up, is more reliable and efficient than the "once over lightly" fast tempo survey now being tried out in several American cities.

* The representative of the Public Health Service Survey Committee estimated that a fast tempo survey in San Francisco would unearth perhaps 375 cases with positive sputum (memo, Hilbish, Calif. State Dept. Pub. Health, Oct. 6, 1948). It is reported that there are about 200 known cases with positive sputum in that city not now under isolation or hospital care. Should not these be attended to first?

8. Useful as roentgen surveys are, more precise criteria are needed for the early detection of active pulmonary tuberculosis.

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SEVERE HYPERTROPHIC PULMONARY OSTEOARTHROPATHY

REPORT OF A CASE DUE TO CARCINOMA OF THE LUNG WITH OPERATION AND RECOVERY

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CLUBBING of the fingers in phthisis was noted by Hippocrates in biblical times. Shortly before Röntgen's discovery of the x-ray, Bamberger (1889) and Marie (1890) described the association of thickening of the arms and legs with clubbing of the digits, and noted its occurrence in other types of pulmonary disease and in congenital heart disease. These reports served to separate the entity of hypertrophic pulmonary osteoarthropathy from such diseases as acromegaly, osteitis deformans and syphilitic periostitis. Somewhat later (1915) Locke[3] in a monumental treatise irrefutably linked the digital clubbing and the periosteal changes of other long bones in hypertrophic osteoarthropathy as a single clinical syndrome. Recently, Van Hazel[6] (1940) described 5 cases of hypertrophic pulmonary osteoarthropathy in whom joint manifestations were the presenting symptom complex of pulmonary neoplasm. Thus a thorough search must be made for malignant growths of the lung in any case presenting this syndrome; since one may, in these cases, find the tumor while it is in an operable phase.

The following case shows the difficulties encountered in such a search and shows how extremely elusive the primary diagnosis may remain in spite of careful prolonged observation.

CASE REPORT

F. E., a white male, aged fifty, was first seen by me on January 12, 1947, because of painful swelling of the feet and ankles of six weeks' duration. He stated that in 1933 he had fainted on the street and was taken to Bellevue Hospital. He was told that his lung had collapsed spontaneously and he remained for six months on the chest service during which time pneumothorax was maintained. Upon discharge, he was reassured as to the absence of tuberculosis, and he was told that he had suffered from an emphysematous bleb. He recalled the medical students examining his fingers and commenting on the clubbing. Subsequent recheck supported this, but the clubbing was characterized as slight to moderate. Apart from this episode, he enjoyed excellent health, and served in Egypt and the Far East in World War II as an engineer. He denied any venereal diseases. For the past ten years he had been accustomed to taking from a pint to a quart of whisky a day but he always ate at least one good meal a day. He smoked from two to three packages of cigarettes a day and for years had a matutinal cough productive of grayish mucoid sputum. This had not altered in any respect with the present illness.

Early in December, 1946, while sojourning in Hot Springs, Arkansas, he noted following the spa baths and general body massage, a lingering myalgia. Shortly afterward, his ankles began to swell and he came home to consult a physician. Roentgenograms of his chest (Fig. 1)and ankles, blood count and sedimentation rate were done at New York Hospital and he was told he had acute rheumatic fever. Bed rest and salicylates were prescribed without improvement.

At the time he visited my office, he was wearing shoes about two sizes larger than usual because of marked swelling of the feet and ankles. He had noted intermittent fever as high as 101° F.

Physical examination showed a well developed slender man, weighing 163 pounds. The heart and lungs were normal. Blood pressure 130/88. The liver descended three fingers below the costal margin but the edge was felt with difficulty and its character was hard to determine from palpation. There were painful and edematous internal and external hemorrhoids. Both legs and feet were markedly edematous; the swelling pitted but was not particu-

larly warm or red. There was unmistakable clubbing of the fingers and toes. The mobility of the ankle joints, however, did not seem impaired by pain nor limited in motion except by the edema outside the joint. A urinalysis was negative with a specific gravity of 1.024. Hemoglobin was 90 per cent, red blood cell count 4,660,000, white blood cell count 10,850, with 62 per cent polymorphonuclear leukocytes and 14 immature forms.

The impression was one of early portal obstruction due to cirrhosis of the liver. He was placed on a well balanced high protein, high carbohydrate diet with supplementary injections of vitamin B complex and diuretics. Improvement was gratifying for about two weeks until he suddenly developed painful, hot, red swelling about the knee joints with hypesthesia of the pretibiae and fever to 102° F.

He was admitted to the Lenox Hill Hospital on January 28, 1947, and roentgenograms (Fig. 2) of the knees and ankles showed a small amount of fluid in the suprapatellar pouch on the left but no arthritis or joint pathology. However, irregular periosteal new bone formation could be seen along the shafts of both femora and both tibiae. From the roentgenologist's point of view this represented a luetic periostitis. Repeated Wassermann, Kline, and Mazzini tests were negative. Serum proteins, blood chemistry were within normal limits. Sedimentation rate was 72 mm. per hour. The chest roentgenogram taken at New York Hospital was secured and was negative except for a slight obliteration of the sulcus on the right, probably a residual from his old bullous emphysema.

It was decided to discharge him and try penicillin as a therapeutic test on the basis that the process was luetic. Twelve injections of 300,000 units in wax given daily resulted in no improvement and was abandoned with the onset of intense urticaria followed by a mild exfoliative dermatitis. When this cleared mapharsen was tried along with sodium iodide intravenously. Five injections of these gave negative results. The ostealgia now involved the ulnae and radii and a painful bilateral mastitis (gynecomastia) was noted.

He was readmitted to the hospital and a posteroanterior roentgenogram (Fig. 3) of the chest was taken which was negative, but a lateral view showed an area of infiltration about the size of a silver dollar lying directly posterior to the heart (Fig. 4). It will be noted that the lesion was completely obscured by the heart shadow in the posteroanterior films. It is of considerable interest that having finally been identified in the lateral view, the lesion could also be made out faintly in the lateral film taken four months earlier.

By this time, he had begun to notice a little blood-streaking in his sputum. Bronchoscopy was entirely negative.

On April 1, 1947, a left lower lobectomy was done and a primary squamous cell carcinoma of the lung was removed. Lobectomy rather than pneumonectomy was selected as the procedure of choice because of the possibility of respiratory embarrassment due to his pre-existing pulmonary disease.

Fig. 1. Film taken at New York Hospital, about ten days after onset, showing only old obliteration of right costophrenic sulcus.

He did well except for one episode two and a half weeks postoperatively of a localized empyema which yielded to antibiotics injected transthoracicly and parenterally. There was immediate and progressive improvement (cf. Fig. 2*C*) in the ostealgia and clubbing and ultimately but much more slowly in the gynecomastia. At the present writing there are no signs of recurrence.

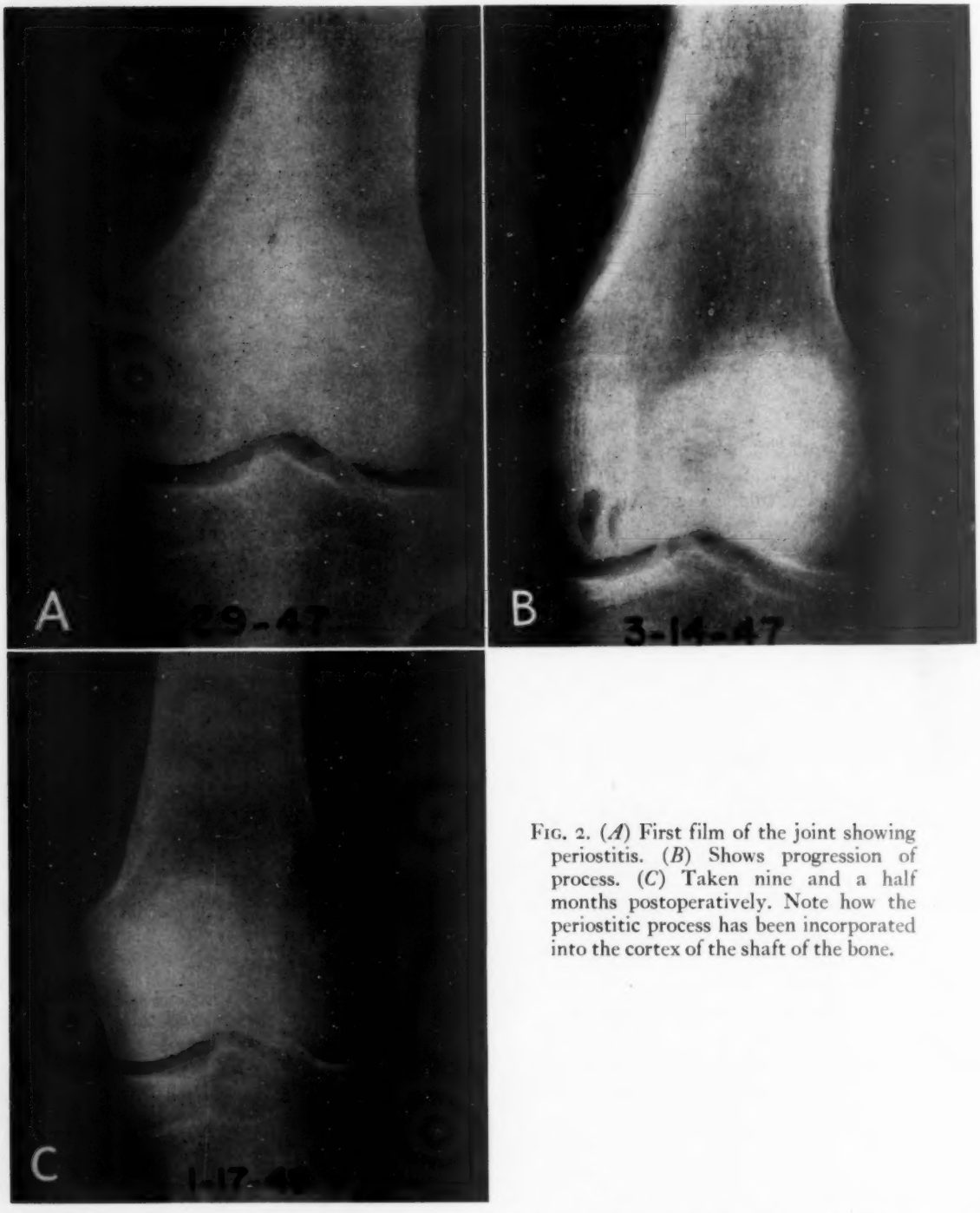

Fig. 2. (*A*) First film of the joint showing periostitis. (*B*) Shows progression of process. (*C*) Taken nine and a half months postoperatively. Note how the periostitic process has been incorporated into the cortex of the shaft of the bone.

Comments. Stress should be placed on the way in which this case simulated acute rheumatic fever on at least two occasions. Syphilis might also have accounted for most of the signs and symptoms. Like this case others have also been mistaken for rheumatoid arthritis. The old history of clubbing and the episode of spontaneous pneumothorax also served to lead one away from the correct diagnosis because of the duration. The fact that the lesion lay posterior to the mediastinal shadow and that

the first lateral film taken was too soft a film to pick it up delayed the diagnosis still further.

The fact that the remission of pain and associated edema of the affected areas occurred so rapidly deserves comment. Gradually, over a period of weeks, the clubbing has regressed 80 or 90 per cent, and the gynecomastia has entirely disappeared. Roentgenograms taken nine and a half months postoperatively, showed the

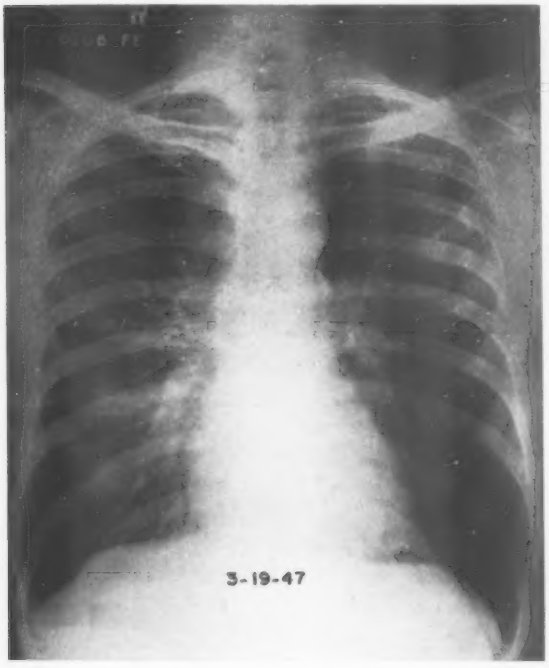

FIG. 3. Another chest film taken three and a half months after onset of symptoms disclosing no pulmonic process.

periosteal thickening to have been incorporated into the cortex of the bones (Fig. 2C).

Concerning the disappearance of the gynecomastia, it is of interest that in a review of the subject of hypertrophic pulmonary osteoarthropathy Dock[1] sums up the pathogenesis of the condition as supporting an endocrine relationship. Fried[2] also has published 4 cases in which gynecomastia and acromegalic changes were evident. He was able to find hyperplasia of the eosinophilic cells of the anterior pituitary gland in most of his cases. Other pathologists[5] have not been able to show morphological changes in this gland. That the thyroid gland may also play some role in clubbing of the fingers in suggested by the fact that the occurrence of digital tufting has been reported[4] in cases of exophthalmic goiter who develop postoperative myxedema.

FIG. 4. Lateral view taken just prior to bronchoscopy clearly demonstrating the lesion lying far but directly posterior to the heart.

Clubbing rarely and gynecomastia frequently are encountered in biliary cirrhosis. The theory is held that the latter is contingent upon the inability of the liver to conjugate estrogens. The fact that both the liver and the lung have two afferent blood supplies (venous and arterial) suggests that this phenomenon of pulmonary osteoarthropathy may be dependent upon an arteriovenous shunt. The conclusion can be drawn that either the lesion itself promotes a stimulus to osseous proliferation or it elaborates a substance that induces the effect by acting through the anterior pituitary gland.

SUMMARY

A severe and unusual case of extensive hypertrophic pulmonary osteoarthropathy is presented secondary to squamous cell carcinoma of the lung. Rapid regression of the bone lesions and the clubbing of the fingers followed surgical removal.

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ROENTGENOGRAPHIC VISUALIZATION OF INTRACEREBRAL HEMATOMAS FOLLOWING PREFRONTAL LOBOTOMY

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INJECTED lipiodol has been utilized to demonstrate roentgenographically the plane and extent of subcortical incision in the frontal lobes after the operation of prefrontal lobotomy, since introduction of the procedure into neurosurgery by Freeman and Watts[1] in 1936. The use of lipiodol continues to be favored by many surgeons because of the easy method of determining from study of postoperative roentgenograms exactly how closely operative division of frontal white matter has approached the intended degree of section. Other substances, notably stainless steel wire,[5] and hydrogen peroxide,[2] have also been employed to visualize the lobotomy slits. Availability, ease of injection, and apparent freedom from tissue reaction make lipiodol the contrast medium of choice. Experience with "pantopaque" indicates that this substance is somewhat too fluid and miscible to imitate the clean lines seen when lipiodol is injected (Fig. 1).

Postoperative hemorrhage accounted for 3 of the 12 surgical deaths in Watts and Durkin's[7] series of 610 lobotomy operations. The incidence of this complication is higher in the group of patients suffering from intractable pain, usually due to carcinoma, who are treated by lobotomy, because of debilitation and bleeding tendency. At the International Conference on Psychosurgery (Lisbon, 1948), it was pointed out by Sjöqvist and collaborators[6] that the examination of roentgenograms of the skull taken postoperatively after the injection of lipiodol into the plane of frontal lobe section may indicate the presence of a hematoma in the incision.

The 2 cases following are presented because the roentgenograms taken immediately after prefrontal lobotomy (radical in one case; minimal, in the other) proved to demonstrate intracerebral hematomas following operation. In the first case, the condition was unrecognized, and the patient died. Autopsy revealed a huge blood clot, apparently the result of laceration of one of the sylvian branches of the middle cerebral artery. In the second case, prompt re-operation resulted in the evacuation of the hematoma and an uneventful convalescence thereafter.

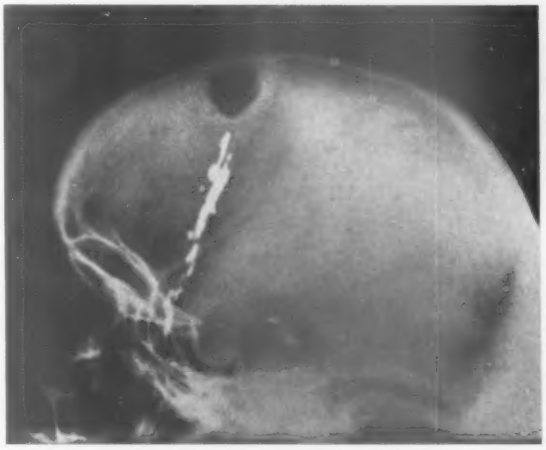

FIG. 1. Lateral roentgenogram of skull, radical prefrontal lobotomy. Lipiodol outlines incisions in frontal lobes from vertex to base.

CASE REPORTS

CASE 1. A white female, aged forty-one, had been mentally ill for eight years, and at the time of operation was an untidy, deteriorated resident of a strong room. The psychiatric diagnosis was catatonic schizophrenia. Radical prefrontal lobotomy (the intended plane of section passing 1 cm. posterior to the sphenoid wings at the base of the brain) was performed on April 29, 1947. Postoperatively the patient did not arouse in the usual time, but there were few changes in the vital signs. Coma persisted, manifestations of decerberate rigidity appeared,

and respirations ceased approximately twenty-eight hours after operation.

Autopsy was performed, and a large hematoma was found to have spread into both areas of incision of the frontal lobes. The clot was lens shaped and communicated with a ventricular cast of more clotted blood. Since the mass was larger on the left, it appeared to arise from the laceration of one of the middle cerebral arteries which spread over the island of Reil. The anterior cerebral arteries were intact.

In retrospect, the lateral skull films taken postoperatively (Fig. 2), revealed the postoperative hematoma in all dimensions. Instead of the usual thin line of lipiodol, oil droplets

Fig. 2. Case 1. Lateral roentgenogram of skull, radical prefrontal lobotomy. Wide scattering of oil droplets in incision. Arrows indicate ring surrounding hematoma.

are seen to be scattered over a wide area, more or less in a vertical direction from the operative skull defects (superiorly) to a point 1 cm. posterior to the sphenoid wing. In part, they form an oval ring, longest superiorly inferiorly. A few droplets are extruded into the extracranial tissues. Correlated with autopsy findings, the clots in the incisions are fairly well outlined.

Case II. A white female, aged thirty-eight, had suffered from chronic, intractable boring pain in the left nose and face, radiating to the neck and shoulder, for sixteen months. Pain had begun in the tip of the nose following the most recent of nine operations upon the left frontal, left maxillary, and ethnoid paranasal sinuses, and had defied all conservative measures of relief. The chief complaint was steady and not lancinating pain; there were no sensory changes in the domain of the trigeminal nerve. The mental reaction accompanying this all-pervasive pain was one of depression and anxiety, and the patient was potentially suicidal. The diagnosis was that of atypical facial neuralgia, severe, which experience indicates has been effectively relieved only by prefrontal lobotomy.[3,4]

Accordingly, minimal (lower quadrants of the frontal lobes only) prefrontal lobotomy was carried out on June 22, 1949. At the time of operation there was considerable bleeding from the region of the left cribriform plate, which appeared to have been controlled at the time of closure.

Postoperatively, the patient had not aroused at the usual time (four to five hours after operation). The blood pressure remained steady at 90/70, and the pulse ranged around 80 per minute. The temperature was normal, but the respirations were deep and snoring. Strong sensory stimulation resulted in adduction movements of the arms and legs, less on the right than the left. The Babinski sign had become evident five hours after operation.

Despite the absence of serious changes in the vital signs, it was apparent that something had gone wrong. Profuse bleeding from the region of the cribriform plate was recalled, and inspection of the films taken immediately after operation revealed the oil to be scattered in droplets in a round or oval fashion.

The patient was re-operated upon six hours after lobotomy closure. The temporal skull defect on the left was enlarged and a lighted retractor inserted. A huge, solid clot, approximately 50 cc. in size, was evacuated, the cavity irrigated, a few bleeding points coagulated, and strips of gel-foam inserted.

Following evacuation of the hematoma, movement returned first to the left and then to the right side of the body. The immediate convalescent period was remarkably smooth, and recovery thereafter also uneventful.

Lateral views of the skull taken after first operation (Fig. 3) disclosed, instead of short lines from the temporal bur holes to the sphenoidal wing, an irregularly oval aggregation of oil droplets in about the center of the frontal fossa. Streaks of lipiodol are also seen in the ventricu-

lar system. There is no doubt that the diffused opacities outlined the hematoma found at second operation.

SUMMARY

Two cases are presented of postoperative intracerebral incisional hematoma following prefrontal lobotomy. In one case, the situation was not recognized and the patient died. In the other, re-operation resulted in removal of the clot in the frontal lobe and recovery. Lipiodol injected after lobotomy outlined the area of bleeding and clot formation in both patients. The value of the use of lipiodol in visualizing lobotomy section is illustrated from an unusual point of view, and the findings of Sjöqvist are confirmed.

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Fig. 3. Case II. Lateral roentgenogram of skull, minimal prefrontal lobotomy. Dispersion of lipiodol. Arrows indicate ring formation in hematoma. Oil in ventricles.

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RIGHT-SIDED STOMACH ASSOCIATED WITH EVENTRATION OF THE DIAPHRAGM SIMULATING HYDROPNEUMOTHORAX*

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CONGENITALLY right-sided stomach usually occurs as part of a general transposition of the viscera.[1] Eventration of the right diaphragm is not infrequently an associated anomaly. The presence of right-sided stomach as the sole evidence of situs inversus is exceedingly rare. During the examination of 412,149 chest roentgenograms at an Armed Forces Induction Station, Kinzer and Cook[4] discovered 5 cases of congenital eventration of the right diaphragm; in 3 of these, the stomach and portions of small and large intestine were present beneath the diaphragm.

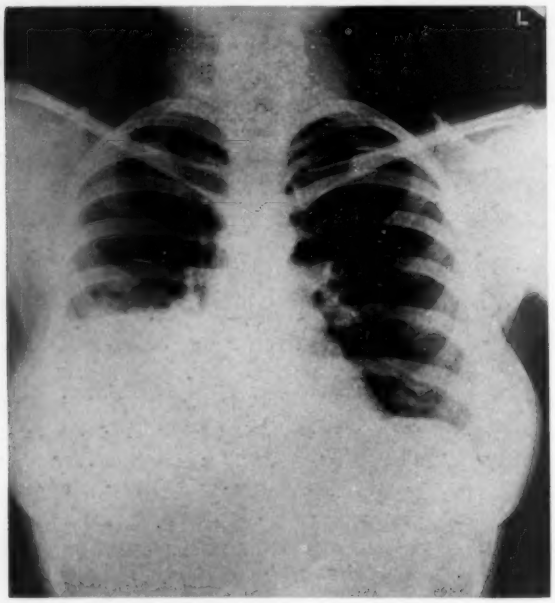

FIG. 1. Diffuse opacity right lower lung field with area of haziness immediately above. Appearance suggestive of pleural reaction with probable underlying pulmonary infiltration.

Right-sided stomach occurs as the result of failure of normal rotation of the foregut in embryonal life. This failure, associated with incomplete descent from its original position in the thorax, accounts for the presence of the stomach above the liver. This anomaly may result in gastrointestinal disturbances within the first few days of life but also is compatible with normal digestion and health. It has been described in a sixteen month old infant who was brought to medical attention because of a gastrointestinal upset resulting from weaning.[3] In other instances, the anomaly may be discovered first in adult life on routine survey films or in the course of an intercurrent illness, as in the subject of this report.

On the routine chest roentgenogram, right-sided stomach associated with eventration of the diaphragm may simulate hydropneumothorax.[2] In particular, when the presenting symptoms of the patient lead to a diagnosis of pulmonary infection, difficulties in the treatment of the illness may arise unless the possibility of congenital anomaly is kept in mind. The presence of right-sided stomach is proved readily by a barium meal. In view of the rarity of the condition and the interesting clinical and roentgen diagnostic problems involved, the following case report is presented.

CASE REPORT

The patient was a housewife, aged thirty-four, admitted to the hospital on October 5, 1948, complaining of right chest pain and cough. Past history revealed an episode of pneumonia in infancy. Since the age of seventeen years, she has been troubled by a postnasal drip associated with a chronic cough. All during childhood up to the age of seventeen, the patient had occasional episodes of postprandial regurgitation of food and vomiting. At one time she had been told that her "esophagus was

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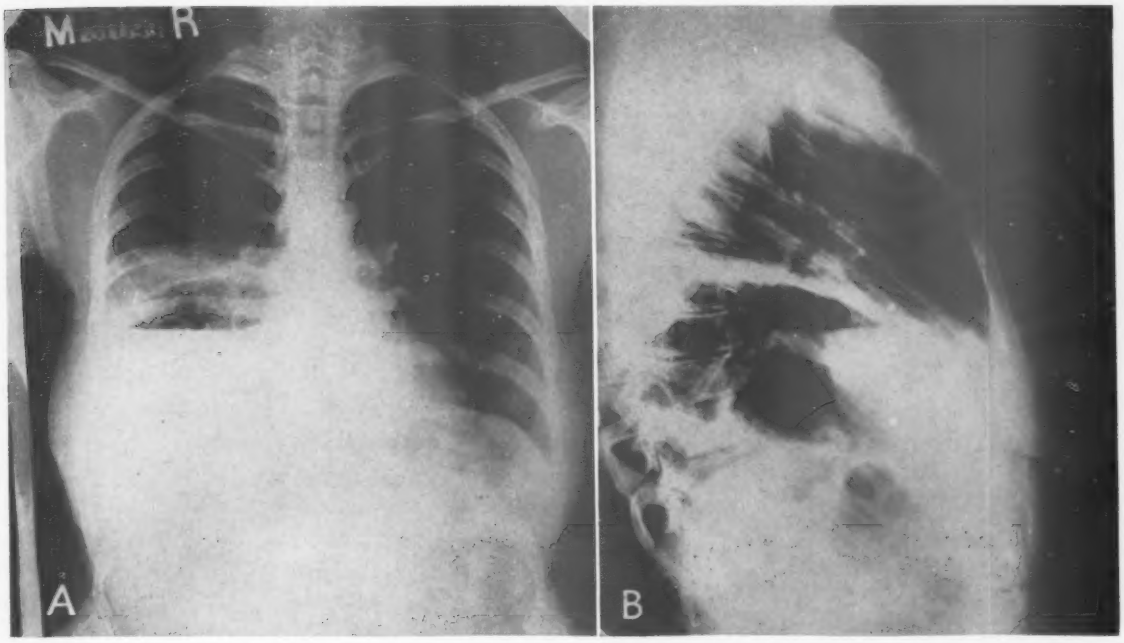

FIG. 2. (*A*) Fluid level in right lower lung field. The appearance is that of air and fluid in the right chest. (*B*) Right lateral view. Fluid level lies within posterior half of right chest.

dilated." All gastrointestinal symptoms had subsided seventeen years ago.

Present illness began two months before admission when she contracted a severe upper respiratory infection. Her usual chronic cough increased in severity and was productive of a moderate amount of non-foul, purulent sputum. Temperature which was elevated up to 102° F. at the onset became normal within a few days but the cough persisted. One week before admission, there was sudden onset of severe sticking pain over the right lower chest markedly aggravated by inspiration; this was associated with pain in the right shoulder. This pain persisted and was only slightly relieved by chest strapping.

Physical examination revealed an uncomfortable patient who did not appear acutely ill. Temperature was 100° F., pulse 96 and respirations 24. There was considerable purulent postnasal discharge and some tenderness over the right maxillary sinus. Respiratory excursion of the right lower chest was diminished. Percussion note ranged from dullness to flatness over the right base with diminished breath sounds of bronchovesicular quality. No rales were heard. Blood pressure was 110 systolic, 68 diastolic. The remainder of the examination revealed no abnormalities.

Routine urinalysis was within normal limits. Red blood cell count was 3.9 million, hemoglobin 13.5 gm., leukocytes 13,700, with 65 per cent polymorphonuclear cells, 22 per cent lymphocytes, 11 per cent monocytes and 2 per cent eosinophils. Concentrated sputum was negative for acid fast bacilli. A chest roentgenogram (Fig. 1) revealed diffuse opacification of the lower third of the right lung field with an area of haziness just above this density.

The initial diagnosis was right sided pleurisy with effusion and probable underlying pneumonitis. Penicillin therapy was started. On the following day, a few fine rales were audible over the right base posteriorly. The patient appeared comfortable and chest pain was less severe; temperature was 100.2° F. Chest roentgenograms, in posteroanterior and right lateral views (Fig. 2, *A* and *B*), now revealed a large fluid level in the lower half of the right lung field located within the posterior half of the chest. The appearance was that of a loculated hydropneumothorax. The relative well-being of the patient and the low grade fever did not seem to be in accord with sudden perforation of the lung and formation of intrapleural fluid. In view of the past history of digestive difficulties, the possibility of congenital anomaly was considered. Barium meal was administered and

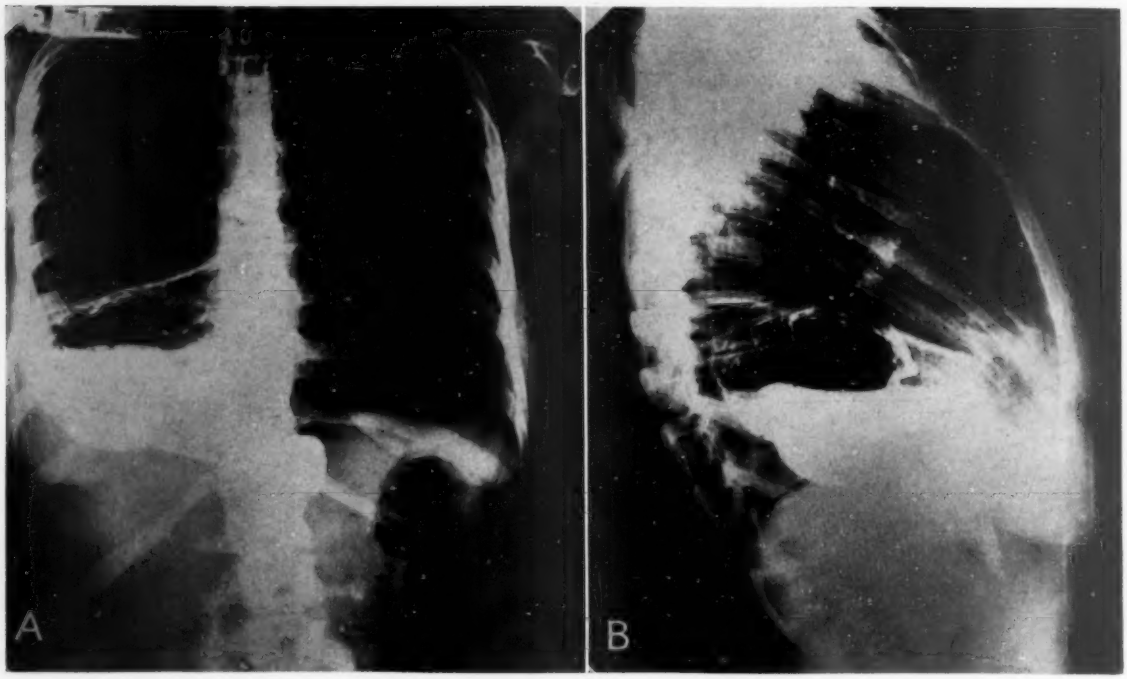

FIG. 3. (*A*) Barium meal has been administered. Fluid level is seen within non-rotated, incompletely descended stomach lying above the liver. The right diaphragm is eventrated and flattened. (*B*) Right lateral view. The right-sided stomach is well outlined.

the diagnosis of right sided stomach and eventration of the right diaphragm was confirmed (Fig. 3, *A* and *B*). On roentgenoscopic examination, the right diaphragm was elevated and somewhat flattened, with impaired mobility. There was no clinical or roentgen evidence of situs inversus of other organs.

Penicillin therapy was continued. Temperature fell to normal on the fourth hospital day and chest pain subsided. All signs of moisture at the right base cleared and the patient left the hospital eight days after admission. It was felt that the acute episode had been a pneumonitis of the right lower lobe with associated pleural reaction in a patient with chronic severe paranasal sinusitis and chronic bronchitis or bronchiectasis. She was last heard from in February, 1949, and has remained well.

SUMMARY

A patient with acute pulmonary infection of the right lower lobe presented on roentgen examination the appearance of a hydropneumothorax. Congenital anomaly was suspected and barium meal demonstrated that the appearance of hydropneumothorax was in reality produced by a right-sided stomach with eventration of the right diaphragm. There was no evidence of transposition of other organs.

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CYSTOGRAPHIC STUDIES IN PLACENTA PRAEVIA*

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THE value of the cystogram as an aid in the diagnosis of placenta praevia is presented in a group study comprising 72 cases. In addition, another sign is described which has aided in the roentgen confirmation of the presence of this obstetric complication.

It has been our experience that cystography plays a very important role as an obstetrical aid and wider recognition should be accorded this procedure. This method of examination alone may sometimes be enough to establish the diagnosis. However, its main use is as an adjunct in clinical evaluation of a suspected case of placenta praevia.

Many roentgenographic techniques have been described and employed to determine the position of the placenta with particular reference to its relationship with the internal os. Menees, Miller and Holly[9] (1930) injected a solution of strontium iodide through the anterior abdominal wall into the amniotic sac. The purpose was to visualize the placenta as a filling defect. It was fraught with danger to the fetus and stimulated expulsion of the uterine contents. In 1934, Snow and Powell[11] described the employment of soft tissue roentgenography to demonstrate the location of the placenta. This was subsequently performed with air and contrast medium within the urinary bladder. Several others have also contributed to the field of soft tissue roentgenography.[2,4,5,6,8] Prentiss and Tucker[10] used the method of distending the bladder with air. Ude and Urner,[12] in 1934, and in subsequent reports,[13] described the method of injecting sodium iodide into the bladder. Others[1,14] have substantiated the work of these pioneers. These methods, in conjunction with clinical findings, proved of great help in the recognition of placenta praevia in a vertex presentation.

There were 21,400 deliveries at Beth-El Hospital between January, 1941, and June, 1948; 104 of these were cases recorded as placenta praevia.

Seventy-two cystograms were taken. Fifty-five of these were diagnosed correctly; 36 were of cases of placenta praevia centralis and lateralis which were corroborated by section; the remainder of this group were of cases which had been clinically suspected as placenta praevia and were diagnosed as negative by cystography. These patients were delivered uneventfully by the vaginal route. The cystograms were considered to be correctly diagnosed.

There were 17 cystograms diagnosed incorrectly. These are divided into two groups. One group, comprised of 7 cases diagnosed as positive for placenta praevia on cystography, were delivered from below. The other group of 10 cases which were reported roentgenographically as negative were classed by operative findings as marginal and/or central placenta praevia.

We have been using the method described by Ude and Urner. After proper preparation, 30 to 35 cubic centimeters of 12.5 per cent of sodium iodide solution are instilled into the urinary bladder. Anteroposterior and oblique views are taken. Frequently, the deformity and pressure defects are observed only on the oblique views.

ROENTGENOGRAPHIC CRITERIA

It is known that in a vertex presentation the tissue interposed between the bony plates of the fetal head and the superior border of a contrast filled urinary bladder is ascribable to the width of the fetal scalp, the lower uterine segment, the fold of peritoneum between the uterus and the bladder, and the thin bladder wall. This space is seldom more than 1 cm. in width.

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FIG. 1. Case 1. A. R. March 27, 1947. At term. Painless bleeding. Thirty cubic centimeters of sodium iodide instilled into the urinary bladder showed the bladder to be asymmetrical. The bladder horn on the right side was lobulated and bifid. There was a 2 cm. spacing at the extreme right between the lobulated right horn and the fetal head. Roentgen diagnosis of a right marginal placenta praevia was confirmed by operation.

FIG. 2. Case 2. M. B. November 12, 1947. At term. Painless bleeding. Thirty cubic centimeters of sodium iodide was instilled into the urinary bladder. There were small areas of concave depressions of the superior aspects of the horns. There was a 4 cm. spacing between the bladder and the fetal head. Roentgen opinion of central placenta praevia was confirmed by operation.

FIG. 3. Case 3. M. L. Para II, gravida I. End of eight months' gestation. There was vaginal bleeding for one day, three weeks prior to roentgen examination. There had been no bleeding since. The head was floating in the midline and the fetal spine was lying transversely across the right side of the abdomen. Thirty cubic centimeters of contrast medium was instilled into the urinary bladder. The superior border of the bladder showed several concave depressions. There was a 7 cm. spacing present. Roentgen diagnosis of central placenta praevia confirmed by operation.

After a careful evaluation of the clinical course, the following roentgenographic findings should be considered in the diagnosis of placenta praevia:

1. The head is high and deviated from the midline.

2. There is more than a 1 cm. spacing with a soft tissue mass interposed between the

Fig. 4. Case 7. H. H. February 17, 1947. Eight months' gestation; 35 cc. of sodium iodide was instilled into the urinary bladder. The head was floating high in the abdomen. The head was to the left of the midline and the spine was lying transversely across the abdomen. There was a 13 cm. spacing between the urinary bladder and presenting fetal part. There were two sharp, well defined concave depressions of the superior border of the urinary bladder. Roentgen diagnosis of central placenta praevia was confirmed by operation.

presenting part and the superior border of the urinary bladder.

3. The bladder horns are asymmetrical. This finding is especially noted in the marginal implantations. An oblique view is routine in our technique as the placenta may be marginal and at times can only be visualized in this view.

During the last eighteen months we have noted an additional roentgen sign, which heretofore has not been described. This sign was recognized in many instances of placenta praevia (see table and figures).

The bladder appears rigid and fixed. The usual concavity of the superior border of the contrast filled urinary bladder may be subdivided to show several concavities;

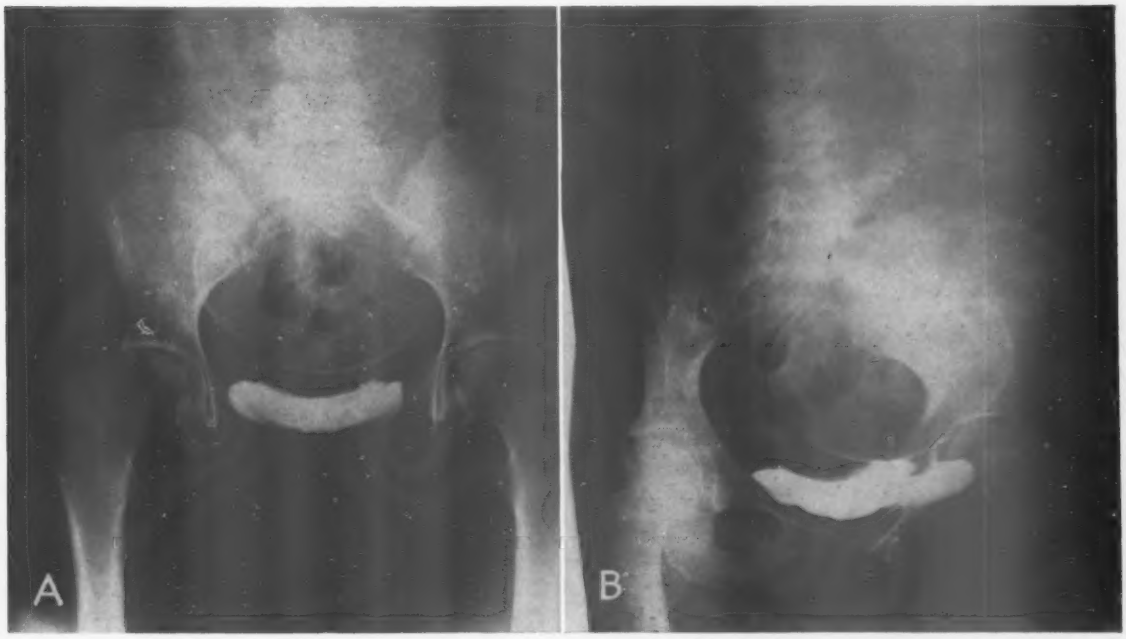

Fig. 5. Case 14. F. W. June 1, 1947. (*A*) On the anteroposterior view the bladder was symmetrical. There was a 1.5 cm. spacing between the bladder and the fetal head. The superior border of the bladder, however, showed several concave depressions. (*B*) On the oblique view, the bladder appeared lobulated and bifid. There were many concave depressions present. The spacing varied from 1.5 cm. in the midline to 4 cm. posteriorly. Placenta praevia confirmed by operation.

FIG. 6. Case 15. M. W. Oblique view. There were several concavities of the superior border of the urinary bladder. There was a 3 cm. spacing between the urinary bladder from the midline and posteriorly. Roentgen diagnosis of placenta praevia confirmed by operation.

FIG. 8. Case 18. S. B. The bladder was asymmetrical. There was a lobulated and concave deformity of the bladder horn on the right side. A soft tissue density was adjacent to this site. There was a 1 cm. spacing between the bladder and the fetal head. Roentgen opinion of the right marginal placenta praevia was confirmed by operation.

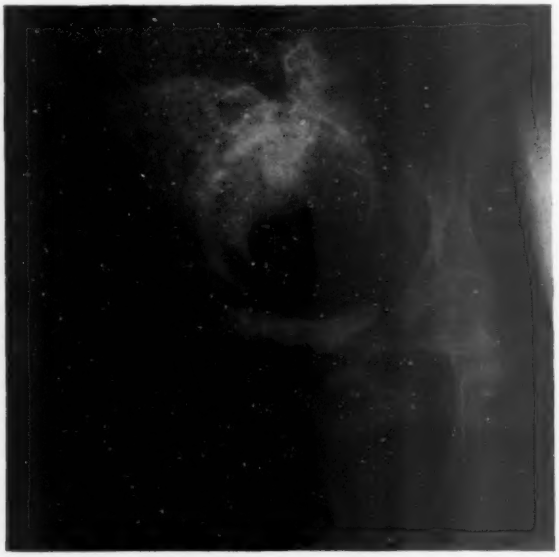

FIG. 7. Case 17. E. B. Right oblique view. There were several subdivided concavities of the superior aspect of the urinary bladder. The spacing between the superior border of the bladder varied from 1 to 3 cm. posteriorly. Roentgen diagnosis of placenta praevia confirmed by caesarean section.

FIG. 9. Case 20. S. G. Oblique view. There were subdivided concavities of the superior border of the bladder. There is a 3 cm. spacing between the superior border of the bladder and the presenting fetal head. Roentgen diagnosis of placenta praevia confirmed by caesarean section.

Fig. 10. Case 21. April 30, 1948. (*A*) Anteroposterior view. Transverse position with the head situated in the right lower quadrant. There was a concavity of the superior and lateral aspects of the urinary bladder. There was a 10 cm. spacing between the superior border of the bladder and the presenting fetal head. (*B*) April 30, 1948. Oblique view. (*C*) May 4, 1948. Right occipito-anterior position. There is a definite concavity of the lateral horn of the urinary bladder. (*D*) May 4, 1948. Oblique view. The anterior aspect of the right horn of the bladder is lobulated. Roentgen diagnosis of central placenta praevia confirmed by operation.

TABLE I

CLINICALLY SUSPECTED CASES OF PLACENTA PRAEVIA SUBMITTED TO CYSTOGRAPHIC EXAMINATION DURING THE LAST EIGHTEEN MONTHS SHOWING OCCURRENCE OF BLADDER ROENTGEN SIGN AND FINAL DIAGNOSIS

Case No.	Name	Age of Gestation	Presentation	Roentgen Diagnosis	Bladder Sign	Final Diagnosis
1	A. R.	Term	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
2	M. B.	Term	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
3	M. L.	8½ months	Transverse	Placenta praevia	Present	Placenta praevia (caesarean section)
4	N. G.	Term	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
5	R. B.	Term	Cephalic	No placenta praevia	Absent	No placenta praevia (vaginal delivery)
6	C. I.	Term	Cephalic	No placenta praevia	Absent	No placenta praevia (vaginal delivery)
7	H. H.	8 months	Transverse	Placenta praevia	Present	Placenta praevia (caesarean section)
8	R. D.	8 months	Cephalic	No placenta praevia	Absent	No placenta praevia (vaginal delivery)
9	F. D.	Term	Cephalic	No placenta praevia	Absent	Placenta praevia (caesarean section)
10	M. G.	Term	Cephalic	Placenta praevia	Absent	Placenta praevia (caesarean section)
11	S. K.	Term	Cephalic	No placenta praevia	Absent	No placenta praevia (vaginal delivery)
12	E. E.	Term	Cephalic	Placenta praevia (marginal)	Absent	Placenta praevia marginal (vaginal delivery)
13	F. A.	7½ months	Cephalic	No placenta praevia	Absent	No placenta praevia (vaginal delivery)
14	F. W.	Term	Cephalic	Placenta praevia (marginal)	Present	Placenta praevia marginal (caesarean section)
15	M. W.	8 months	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
16	S. D.	Term	Cephalic	Placenta praevia	Absent	Placenta praevia (caesarean section)
17	E. B.	8½ months	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
18	S. B.	Term	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
19	L. F.	8 months	Cephalic	Placenta praevia	Absent	Placenta praevia (caesarean section)
20	S. G.	8½ months	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
21	E. N.	7½ months	Transverse	Placenta praevia	Not Definite	
21	E. N.	8½ months	Cephalic	Placenta praevia	Present	Placenta praevia (caesarean section)
22	S. C.	Term	Cephalic	Placenta praevia (marginal)	Present	Placenta praevia (caesarean section)

it may show indentations, angulation, serrations, or even be invaginated. This is probably explained by the fact that the low implantation of the placenta forces the thin lower uterine segment to encroach upon the posterior and superior aspect of

the wall of the bladder, with the resultant extrinsic pressure defect.

The occurrence of the bladder sign in proved cases of placenta praevia has emphasized its value as a corroborative feature in the recognition of the presence of this obstetrical complication.

In the series reported by Beck and Light[3] in which 100 cases with vaginal bleeding in the last trimester were studied by means of Ude's technique of cystography, 16 cases of breech and transverse presentation were excluded because a cystogram was not considered useful in the presence of either of these presentations. Similarly, in the series of 40 cases reported by Hall, Currin and Lynch,[7] 5 cases of breech presentation with bleeding in the last trimester were eliminated from roentgen examination.

The additional bladder roentgen sign described has extended the applicability of cystography in clinically suspected cases of placenta praevia. Cases of transverse presentation are included in this series. The number of confirmed diagnoses of placenta praevia by cystography was increased.

The roentgenographic criteria and the bladder sign presented are given in the illustrations of cases listed in the accompanying table.

Fig. 11. Case 22. S. C. There is a lobulated evagination of the bladder horn on the right side. A soft tissue mass is also noted proximally. Roentgen diagnosis of right marginal placenta praevia confirmed by operation.

SUMMARY

Cystographic studies are of distinct value in the diagnosis of placenta praevia. A group study comprising seventy-two cases has been presented and results detailed.

An additional roentgenographic sign of value in the recognition of placenta praevia has been presented. This sign, comprising the fixation and multiple constant defects seen on the superior border of the contrast filled urinary bladder, is an additional corroborative feature in the diagnosis of placenta praevia.

The bladder roentgen sign has extended the usefulness of cystography in clinically suspected cases of placenta praevia with vertex and other presentations.

The correct diagnosis of placenta praevia by cystography is calculated to be considerably increased.

Grateful acknowledgment is made to the members of the Obstetrical Staffs whose cases constitute this group study.

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Vol. 64, No. 1

TREATMENT OF HODGKIN'S DISEASE WITH ROENTGEN IRRADIATION AND NITROGEN MUSTARDS*

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INTRODUCTION

WHETHER one regards Hodgkin's disease as a true neoplasm, or, at least initially, as a proliferative reaction to the stimulus of an infectious agent, the objective of treatment is the same; namely, the suppression and eradication, if possible, of abnormal cell growth. It should, moreover, be borne in mind that any significant degree of success in the treatment of Hodgkin's disease, leukemia and other forms of disseminated neoplastic disease is dependent upon the resistive capacity of the organism to the harmful diversion of metabolic potentialities.[5] It may be relatively easy to diminish temporarily the rate of abnormal cell growth, but any real value of such therapy lies in the creation of more favorable circumstances for the restoration and maintenance of normal cell function. The therapeutic dilemma arising from this conflict between abnormal and normal potentialities is apparent. Physical and chemical agents which are injurious to pathologic tissue are also, in some degree, harmful to healthy cell structure and function. It is not a mere matter of undesirable side-effects of therapy, but, more important, a possible lessening of the residual defensive powers of the body. Such effects of therapy may explain the deleterious action of irradiation in some advanced cases as well as in acute rapidly progressive forms of Hodgkin's disease, malignant lymphomas and leukemias. It is this concept of the importance of maintenance of natural resistance which provides the basis for the doctrine of early energetic, suppressive therapy, frequently repeated in the presence of evidences of renewed activity of the disease.[8,11]

CLINICAL MATERIAL

One hundred and seventy-three patients with Hodgkin's disease comprise the clinical material of this report. Of this number, 148 cases have been studied with reference to clinical features which may be related to prognosis. These patients were seen at the University of Michigan Hospital during the ten year period beginning July 1, 1934, and information concerning the clinical course and mortality of the members of this group is complete up to January 1, 1948. Only those patients were included in whom the diagnosis of Hodgkin's disease, based upon histopathologic examination, was either made initially or was confirmed by members of the Department of Pathology of the University of Michigan. There were 105 males and 43 females in the series, giving a male ratio of 2.4. The age incidence at the time of onset of symptoms is shown in Table 1. Almost twice as many patients developed evidences of their disease in the third decade of life as in any other ten year period. No members of this series were younger than five years at the time of onset of symptoms.

TABLE I

AGE AT ONSET OF SYMPTOMS

Years	No. of Patients
0–9	7
10–19	21
20–29	43
30–39	23
40–49	22
50–59	17
60–69	11
70–79	4

* From the Thomas Henry Simpson Memorial Institute for Medical Research, University of Michigan, Ann Arbor, Michigan. Presented at the Thirty-first Annual Meeting, American Radium Society, Atlantic City, N. J., June 5–7, 1949.

Roentgen therapy was employed in the treatment of 138 members of this series. Blood transfusion and chemotherapeutic agents and antibiotics for control of intercurrent infection were used as indicated. Medicinal iron preparations and vitamins were prescribed in many instances, but it is doubtful if these measures played any significant part in prolongation of life. Five patients in this series received nitrogen mustard late in the course of their disease, but the administration of this agent could not have affected the survival rate because of the time intervals employed.

TABLE II

DURATION OF LIFE IN A SERIES OF PATIENTS TREATED WITH ROENTGEN IRRADIATION

Survival after Diagnosis	119 Cases
	per cent
One year	59.7
Two years	42.0
Three years	29.4
Four years	25.2
Five years	19.3
Ten years	about 5.0

Since 1946 nitrogen mustard compounds* have been used quite extensively at the University of Michigan Hospital in the treatment of Hodgkin's disease, malignant lymphomas, reticulo-endothelioses, leukemias, and, in a few instances, in other miscellaneous forms of neoplastic disease. The experience gained has been in accord with that reported from other institutions and indicates that these compounds are of greatest value in the management of selected cases of Hodgkin's disease.[1,2,3,4,6,7,9,10,12,13,14,15,16,17]

MORTALITY OF PATIENTS WITH HODGKIN'S DISEASE TREATED WITH IRRADIATION

The survival rates of 119 patients with Hodgkin's disease, calculated from the time of establishment of the diagnosis, are shown in Table II. Only patients on whom accurate information is available up to the time of death or through a five year period are included in the group. It is believed that computation of survival from the date of diagnosis rather than from the presumptive time of onset of the disease is more valuable for comparative purposes in dealing with groups of cases. Most of the patients in this series received their diagnosis within a few months of the time of onset of symptoms or recognized adenopathy. A few, however, had asymptomatic lymph node enlargement for several years prior to the diagnosis. It is believed that approximately 5 per cent of the members of this series have had their disease for ten years or longer.

Among the more common manifestations of Hodgkin's disease which may be of importance in prognosis are fever, pruritus, demonstrable intrathoracic disease, palpable splenomegaly, anemia, abnormalities of the leukocyte count and differential count, and elevation of the sedimentation rate.

Fever is almost invariably present at some time during the course of Hodgkin's disease. It may exhibit Pel-Ebstein characteristics but, in our experience, is more often of an irregular septic type. Occurring early in Hodgkin's disease high fever does not have the exceedingly grave prognostic significance that is indicated by its presence in lymphosarcoma and leukemia. Nevertheless, patients in our series who had fever as an early manifestation showed a survival rate of 47 per cent at the end of one year after diagnosis, as compared to a one year survival rate of 60 per cent for the entire series.

Pruritus rarely occurs as an early manifestation of Hodgkin's disease and is usually absent in patients with the more rapidly progressive forms of the disease. Severe itching was a major complaint of 21 per cent of the patients in our series, and developed, for the most part, late in the course of their disease. Thirty-six per cent of the patients who exhibited pruritus at some time during their illness survived for a period of five years after their diag-

* Generously supplied by Merck and Co., Inc., Rahway, N. J., with the authorization of the National Research Council.

nosis had been established. The five year survival rate of patients without pruritus is 17 per cent. On the other hand, the presence of pruritus indicates, usually, widespread and deep lymph tissue involvement, and when it occurs is of unfavorable prognostic significance.

Mediastinal or hilar adenopathy, demonstrable by roentgen examination and sometimes associated with parenchymal infiltration or pleural effusion, occurred in 60 per cent of our cases. Patients exhibiting this manifestation, for the most part, fell in the group with moderately active progressive disease. The survival rates for patients with and without evidences of intrathoracic Hodgkin's disease are shown in Table III.

Table III

DEMONSTRABLE INTRATHORACIC ADENOPATHY

Survival after Diagnosis	Present (70 cases)	Absent (46 cases)
	per cent	per cent
One year	63.0	54.5
Three years	28.5	32.6
Five years	15.5	26.1

Splenomegaly, apparent by clinical examination, is an unfavorable early sign in Hodgkin's disease. Twenty-eight per cent of our patients were found to have enlargement of the spleen at the time of their first examination. Our experience indicates that of the commoner physical signs occurring in Hodgkin's disease splenomegaly is the most significant as an indication of grave prognosis. The survival rates for patients with and without splenomegaly at the time of initial examination are shown in Table IV.

Patients in our series who exhibited any significant degree of anemia at the time of their first examination survived, on the average, for a shorter period than those without anemia, as shown in Table v. Of greater significance from a prognostic standpoint are changes in the leukocyte values. At the time of initial observation 16 per cent of our patients had leukocyte counts consistently below 6,000 per cu. mm. Although the normal range of leukocytes includes values below this limit, our experience indicates that in Hodgkin's disease leukocyte counts consistently less than 6,000, not attributable to roentgen or nitrogen mustard therapy, are of prognostic importance and usually are associated with extensive bone marrow involvement. Total leukocyte values greater than 10,000 are found much more frequently in Hodgkin's disease than abnormally low counts and were observed in 40 per cent of our patients. The prognostic significance of a high white blood cell count is almost as grave as that of a low count for three year survival after diagnosis (Table VI). Slight to moderate neutrophilia, variable monocytosis, and often profound lymphocytopenia are the commonest changes in the differential leukocyte picture in patients with Hodgkin's disease. Of these, lymphocytopenia possesses the greatest significance, but it is difficult to relate quantitative variations in leukocyte

Table IV

DEMONSTRABLE SPLENIC ENLARGEMENT AT TIME OF DIAGNOSIS

Survival after Diagnosis	Present (31 cases)	Absent (79 cases)
	per cent	per cent
One year	42.0	67.0
Two years	6.5	57.0
Three years	3.2	40.5

Table V

HEMOGLOBIN LEVEL AT TIME OF DIAGNOSIS

Survival after Diagnosis	Hemoglobin Above 11.0 gm. (70%) (56 cases)	Hemoglobin 11 gm. or less (38 cases)
	per cent	per cent
One year	67.9	45.0
Three years	32.1	18.5
Five years	23.2	8.0

TABLE VI

LEUKOCYTE COUNT AT TIME OF DIAGNOSIS

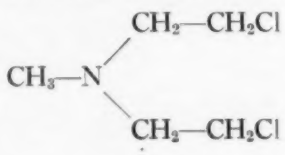
Survival after Diagnosis	Leukocytes 6,000–10,000 (44 cases)	Leukocytes Above 10,000 (40 cases)	Leukocytes Less than 6,000 (16 cases)
	per cent	per cent	per cent
One year	66.6	57.5	43.8
Two years	52.3	37.5	25.0
Three years	40.9	20.0	12.5

types to prognosis. Eosinophilia is an inconstant finding in Hodgkin's disease, and is present in only a small percentage of cases. Elevation of the sedimentation rate was found, at the initial examination, in over 80 per cent of the patients on whom this determination was performed. Although, in general, a rapid sedimentation rate may be considered as evidence of activity of the Hodgkin's process, the test has, in our experience, been of limited prognostic value.

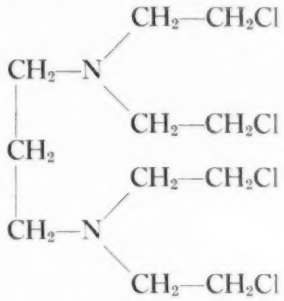
EXPERIENCES WITH NITROGEN MUSTARD

Sufficient time has elapsed to permit preliminary evaluation of the results of administration of nitrogen mustard in 30 cases of histopathologically verified Hodgkin's disease, particularly in the management of the more advanced and more disseminated forms of the disease. A much longer period will be required to determine the ultimate value of the combined use of roentgen irradiation and nitrogen mustard in the treatment of early and more slowly progressive Hodgkin's disease.

A total of 81 courses of nitrogen mustard have been given and the greatest number of courses received by one patient is nine. The compound employed in the majority of administrations has been methyl bis (β-chloroethyl) amine hydrochloride (HN_2), of which the chemical formula is:



Early in 1948 another nitrogen mustard compound, 1,3,-bis [bis (β-chloroethyl)] aminopropane dihydrochloride ("SK 136"), was made available and has subsequently been employed in amounts about equal to those of HN_2. "SK 136" is a double HN_2 compound with the formula:



"SK 136" produces less severe immediate toxic reaction than HN_2, probably because it undergoes cyclization in the body more slowly. Disturbances of sleep, vivid dreams and "hangover" sensations on the day following injection are more common after "SK 136" than HN_2 administration, but the freedom from severe nausea, vomiting and retching afforded by "SK 136" has proved a distinct asset in the treatment of some patients.

Both of the nitrogen mustard compounds employed by us have been given according to the same general plan of administration; namely, a usual dose of 0.1 mg. per kilo of body weight, but not exceeding 6 mg., administered intravenously at two day intervals for a total of four treatments. This regimen has been modified in a number of cases, usually by decreasing the dosage or number of treatments in severely ill patients. A few patients with widely disseminated disease have been given single injections at three to four week intervals over periods of several months. At least five weeks have been allowed to elapse between administrations of full courses of the drugs.

Depression of the bone marrow constitutes an important hazard of nitrogen mustard therapy. A decline in hemoglobin and erythrocyte values occurred quite frequently after administration of the drug,

but was never sufficiently marked to be a cause of concern. Since many of the patients had moderate or severe degrees of anemia before institution of specific therapy, and were given transfusions, the effect of nitrogen mustard on erythrocytic values was often masked. Patients who responded favorably to the drug frequently showed actual increases in erythrocyte count and hemoglobin level within two to four weeks after its administration.

Slight to moderate reduction in platelet numbers occurred quite commonly after nitrogen mustard administration, but, in this series, there were no instances of hemorrhage attributable to drug induced thrombocytopenia.

The number of circulating leukocytes was almost invariably reduced after mustard therapy. Declines to levels below 5,000 per cu. mm. occurred in 60 per cent of the patients, although not necessarily after each course of therapy. Counts below 2,000 per cu. mm. were observed in 6 patients (20 per cent). The leukocyte values tend to decline progressively for about three weeks after nitrogen mustard therapy, and, in favorable cases, subsequently rise, attaining normal levels in five to six weeks after the institution of treatment. Severe infection, resulting from leukopenia, can almost always be avoided by close supervision of the patient and the use of antibiotics.

Clinical remissions induced by nitrogen mustard have varied in duration from a few days to several months. The longest interval between courses of nitrogen mustard therapy, in a patient who did not receive irradiation, was eight months. However, it has been our practice to repeat the administration of nitrogen mustard, or institute roentgen therapy without waiting for evidences of severe exacerbation of the disease.

TABLE VII

THERAPEUTIC RESULTS IN 30 CASES TREATED WITH NITROGEN MUSTARD

Clinical Type and State of Disease When First Treated	No. of Cases	No Improvement	Transient Improvement but Unsatisfactory Control	Good Control for at Least Six Months	
				Combined with Roentgen Therapy	Without Roentgen Therapy
Advanced, generalized, previously treated with roentgen therapy	16	1	6	6	3
Moderately advanced with severe pruritus	2	0	0	0	2
Moderately advanced with post-irradiation tissue damage	4	0	0	0	4
Early localized not previously treated with roentgen therapy	2	0	0	2	0
Acute and rapidly progressive	6	3	3	0	0

The effects of therapy with nitrogen mustard are summarized in Table VII. Of the 30 patients treated with nitrogen mustard there were 16 with advanced generalized Hodgkin's disease previously treated with roentgen irradiation. Of these, 9 had their disease satisfactorily controlled for at least six months, although 6 patients received roentgen therapy as well

as nitrogen mustard. Six of the members of this group had only transient response to nitrogen mustard and 1 had no improvement following its use.

Two patients with moderately advanced Hodgkin's disease, whose major complaint was severe itching, had their pruritus satisfactorily controlled for longer than six months by the use of nitrogen mustard.

Four patients with moderately advanced Hodgkin's disease and radiation tissue damage, including 2 with pulmonary fibrosis, have had their disease satisfactorily controlled for six months or longer by nitrogen mustard therapy.

Two patients with early localized Hodgkin's disease were treated initially with nitrogen mustard and subsequently with roentgen irradiation. Remissions have been satisfactory, but the value of combined therapy in these cases has not yet been established.

Included in the series are 6 cases of acute and rapidly progressive Hodgkin's disease. Three of these patients had transient dramatic relief of symptoms and regression of tumors, but there was little or no apparent effect on the duration of their illnesses. The other members of this group had no improvement following nitrogen mustard therapy.

ILLUSTRATIVE THERAPEUTIC RESPONSES

CASE 1. Hodgkin's disease of long duration illustrating widespread involvement and satisfactory response to roentgen therapy. Female, aged twenty-two at time of first admission. The patient was admitted on November 11, 1937, with complaints of weakness, chills, fever and night sweats. She gave a history of development of cervical lymph node enlargement at the age of ten years and had been treated elsewhere for Hodgkin's disease with roentgen rays and radium, and blood transfusions. Examination revealed pallor, undernutrition, enlarged cervical nodes and splenomegaly. Roentgen therapy to retroperitoneal regions was followed by an excellent clinical remission. Subsequently, biopsy of a node was performed and the diagnosis of Hodgkin's disease was verified.

Onset of abdominal pain and gastric hemor-

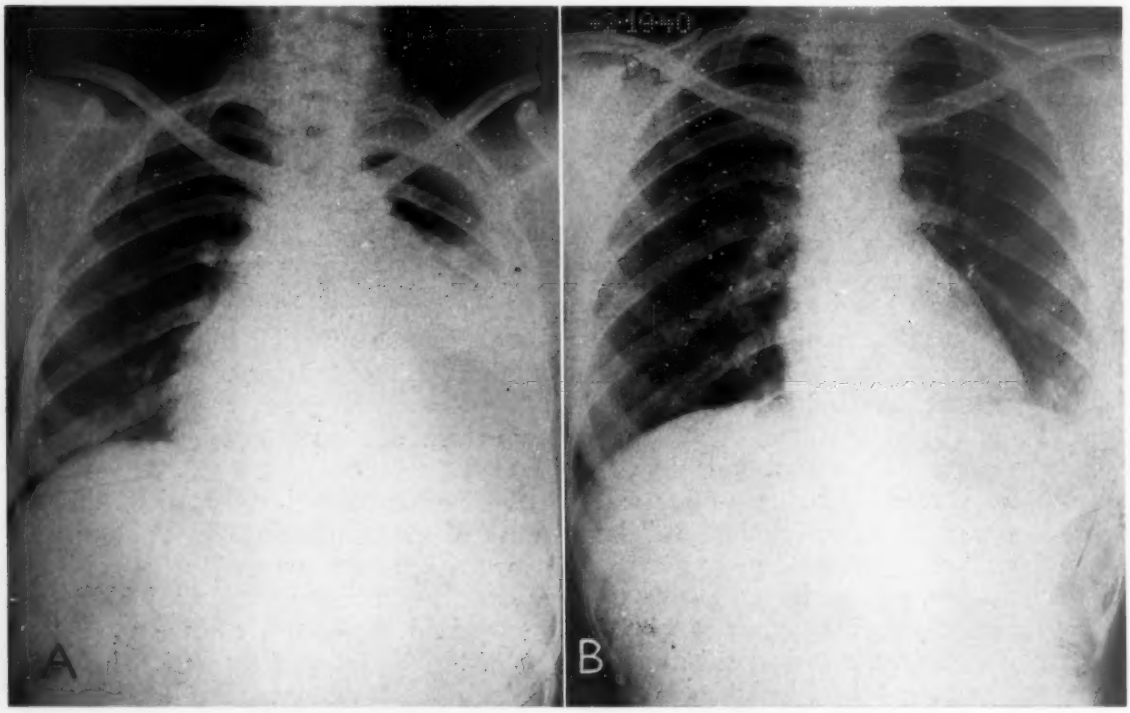


FIG. 1. Case 1. (*A*) January 13, 1940. Pleural effusion in Hodgkin's disease of fifteen years' duration. (*B*) February 19, 1940. Clearing of pleural effusion after roentgen therapy.

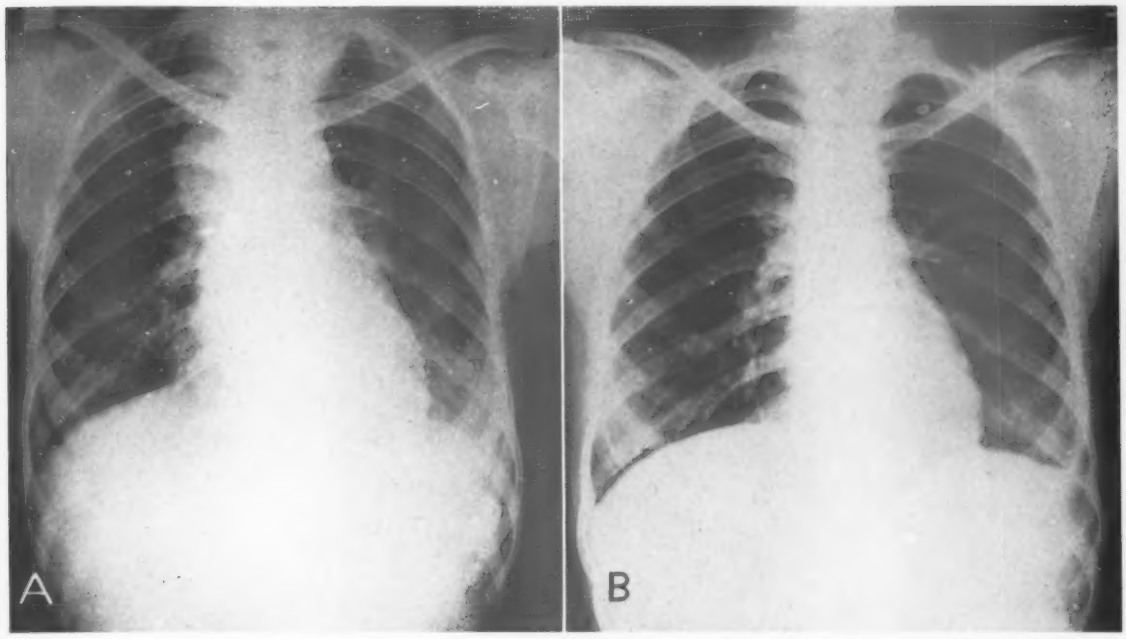


Fig. 2. Case 1. (*A*) October 26, 1944. Four years later. Mediastinal adenopathy. (*B*) November 27, 1945. Regression of adenopathy following roentgen therapy.

rhages occurred in April, 1938. Roentgen examination revealed invasion of the stomach by neoplasm. The lesion disappeared after upper abdominal and retroperitoneal irradiation, and recurred in 1939, again with post-irradiation regression. There was no further evidence of recurrence until 1944.

Pleural effusion developed in 1939–1940 (Fig. 1*A*) and cleared rapidly after roentgen therapy (Fig. 1*B*), without recurrence until 1946. Mediastinal adenopathy was apparent in October, 1944, with regression following roentgen treatment (Fig. 2*A*, *B*). There was exacerbation of all manifestations in 1946 with death in June, 1946. Autopsy was not performed.

Case II. Survival for more than sixteen years in a patient with early extensive osseous involvement. Male, aged twenty-nine at time of first admission. The patient was admitted on July 11, 1933, with complaints of weakness and masses in the neck and axillae of two years' duration, head drawn to left with limitation of motion of seven months' duration, and weight loss of 50 pounds. The diagnosis of Hodgkin's disease of sarcomatous type had been made by biopsy of cervical node performed in January, 1932.

Examination revealed emaciation, generalized peripheral adenopathy, and flexion and rotation of neck to left with marked limitation of motion. There was roentgen evidence of a soft tissue mass obscuring the upper mediastinum, and extensive destructive lesion involving the fourth, fifth and especially the sixth and seventh cervical vertebrae (Fig. 3*A*).

Roentgen therapy was followed by progressive gradual systemic improvement and reossification of the cervical spine (Fig. 3*B*, *C*). Fifteen courses of irradiation were administered to cervical, axillary and mediastinal fields over a fourteen year period. The patient remained active and in reasonably good health until 1946, when he developed manifestations of radiation tissue damage including necrosis of skin and sinus tract formation. Because of these changes and exacerbation of intrathoracic disease with lytic rib lesions (Fig. 4) treatment with nitrogen mustard was instituted. He received six courses of this medication between November, 1946, and April, 1948, with good control of the Hodgkin's disease. Death occurred at home in July, 1948, due to massive hemorrhage from an ulcerated left cervical vessel. Autopsy was not performed.

Case III. Predominant intrathoracic involvement controlled by the combined use of roentgen therapy and nitrogen mustard. Fe-

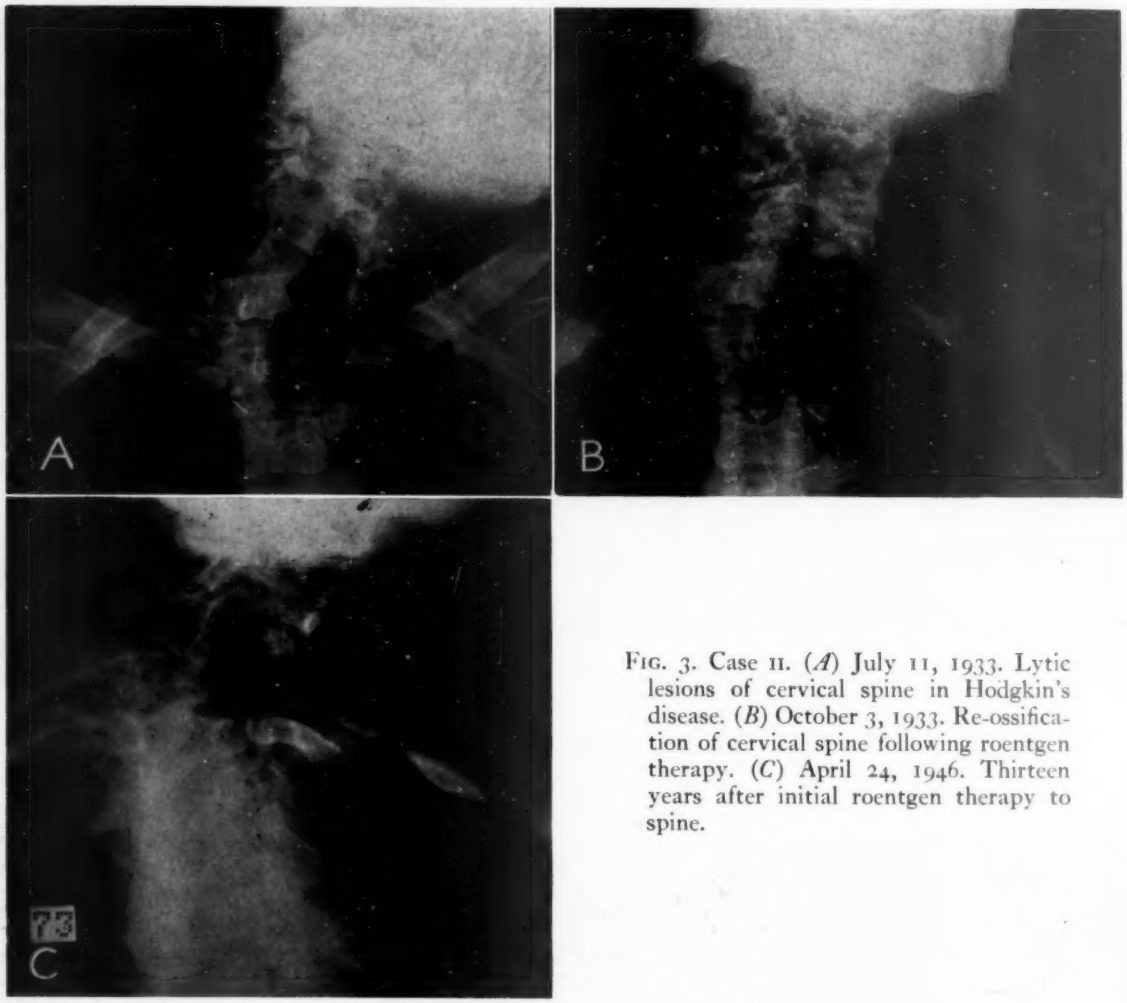


FIG. 3. Case 11. (*A*) July 11, 1933. Lytic lesions of cervical spine in Hodgkin's disease. (*B*) October 3, 1933. Re-ossification of cervical spine following roentgen therapy. (*C*) April 24, 1946. Thirteen years after initial roentgen therapy to spine.

male, aged twenty-three at time of first admission. The patient was admitted on August 28, 1940, with pain in chest, cough, fatigue, weight loss of six months' duration. Physical examination was negative except for pulmonary osteoarthropathy. There was roentgen evidence of a rounded mass arising from the anterior inferior mediastinum on the right (Fig. 5*A*).

In the absence of peripheral adenopathy available for biopsy, a therapeutic test of irradiation was given over the intrathoracic mass with a lasting regression of the tumor (Fig. 5*B*). Exacerbation of the disease occurred in 1943, two weeks after delivery of a normal full term infant, with the appearance of a nodular mass adjacent to the left hilus, and peripheral lymphadenopathy. The diagnosis of Hodgkin's disease was made by biopsy of a supraclavicular node. Seven courses of radiation therapy were given between 1943 and 1948.

Roentgen evidence was present on January 30, 1948, of mediastinal adenopathy in the right middle and left superior regions and a nodular density in the left lower lobe (Fig. 6*A*). It was the opinion of the radiotherapist, Dr. Isadore Lampe, that although full tolerance to the roentgen ray had not been reached further irradiation might lay the background for pulmonary fibrosis. Accordingly, nitrogen mustard was given with regression of the intrathoracic disease (Fig. 6*B*). Roentgen therapy was resumed in 1949 when evidence of disease activity recurred in spite of nitrogen mustard administration. On October 3, 1949, when last seen, the patient's clinical condition was good.

THERAPEUTIC CONSIDERATIONS

It is the present consensus of almost all observers that judicious treatment of

Hodgkin's disease not only increases the patient's comfort, but materially prolongs life. Therefore, it is important to evaluate factors which may affect prognosis and may influence the choice of therapy.

The treatment of Hodgkin's disease may be considered in terms of its specific objectives and the forms of treatment available.

Complete eradication of the disease when apparently well localized and accessible may reasonably be hoped for, but is very rarely accomplished. Surgical excision of a single group of nodes, although it may fail to eliminate all Hodgkin's tissue, is often followed by a better effect from irradiation than would otherwise have been expected. In any event, surgery should never be considered an adequate form of therapy, and should always be followed by irradiation.

Suppression of disease activity is the goal of therapy in the majority of patients with Hodgkin's disease. In early and asymptomatic cases such suppression

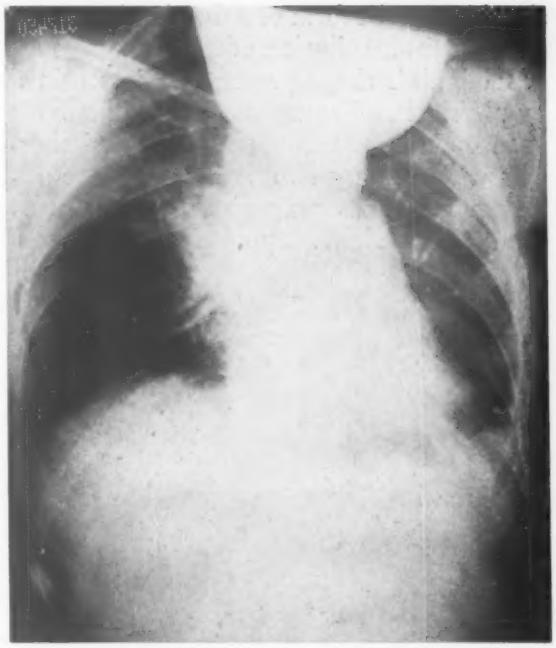


Fig. 4. Case II. March 15, 1949. Fifteen years after Figure 3*A*. Intrathoracic Hodgkin's disease and lytic rib lesions. Nitrogen mustard therapy instituted because of post-irradiation tissue damage.

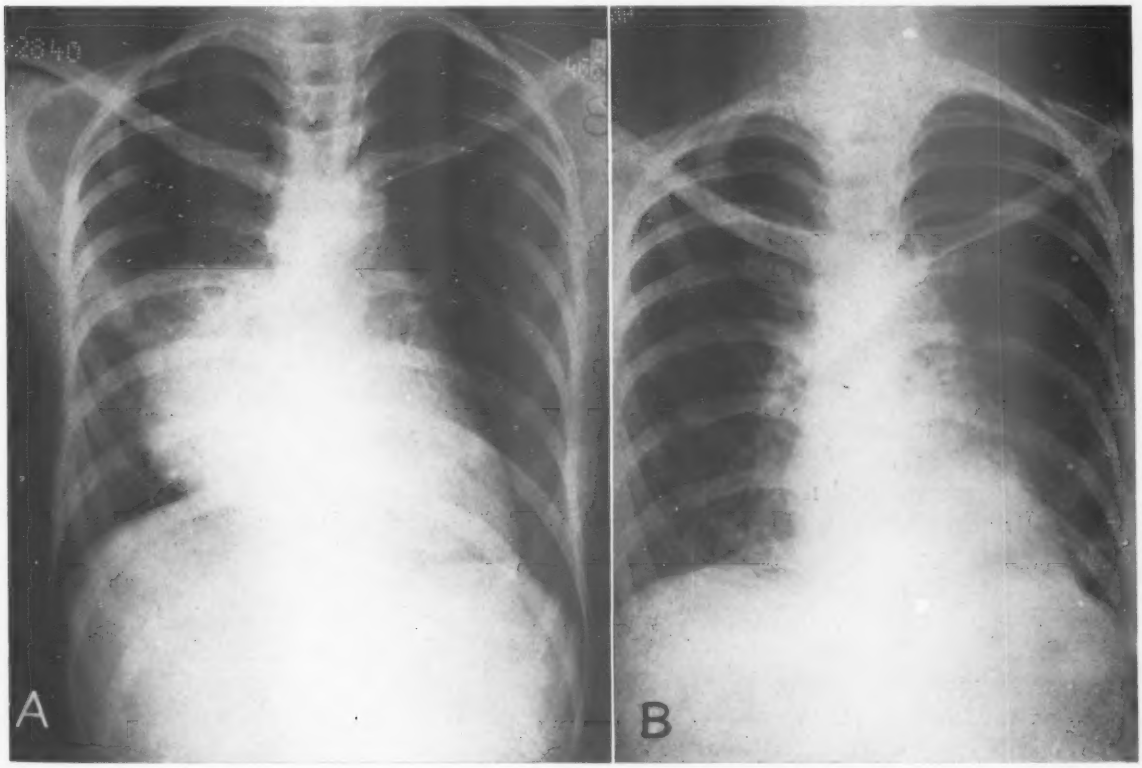


Fig. 5. Case III. (*A*) August 28, 1940. Intrathoracic mass presenting finding in Hodgkin's disease. (*B*) January 25, 1943. Disappearance of mass after roentgen therapy.

should take the form of reduction by means of roentgen irradiation of the total amount of Hodgkin's tissue present, as determined by physical and roentgen examination.

In more advanced cases combined therapy with roentgen radiation and the nitrogen mustards may give better results than either alone. Lymph node enlargements are usually best treated with roentgen irradiation as they appear. Systemic manifestations, such as profound fatigue, anorexia, fever and pruritus, may be advantageously controlled with nitrogen mustards, but consideration should also be given, in such cases, to retroperitoneal irradiation (Charts I and II).

Osseous involvement is usually best treated with roentgen irradiation. Pleural effusion is an indication for irradiation to anterior and posterior mediastinal areas. Diffuse central nervous system involvement may be temporarily benefited by nitrogen mustard therapy.

Sufficient experience with nitrogen mustard compounds has now been gained to formulate certain fairly well defined principles as guides to their use in the treatment of Hodgkin's disease. The ultimate place of these chemical agents in therapy, and particularly their usefulness in association with other measures, is not yet known. The relatively high degree of specific action of the nitrogen mustards in clinical doses on proliferative cells of mesenchymal origin forms the basis for their use in the treatment of Hodgkin's disease, malignant lymphomas and leukemias. Lymphatic and hemopoietic tissues throughout the body are uniformly affected with inhibition of mitotic division and depletion of cellular elements. The depression of normal hemopoietic function is a major factor in narrowing the margin of safety in the use of these compounds. On the other hand, the duration of effect is relatively short, a feature which both limits the therapeutic usefulness of the nitrogen mustards and lessens the hazards of their administration.

In the treatment of patients with Hodgkin's disease the nitrogen mustards have

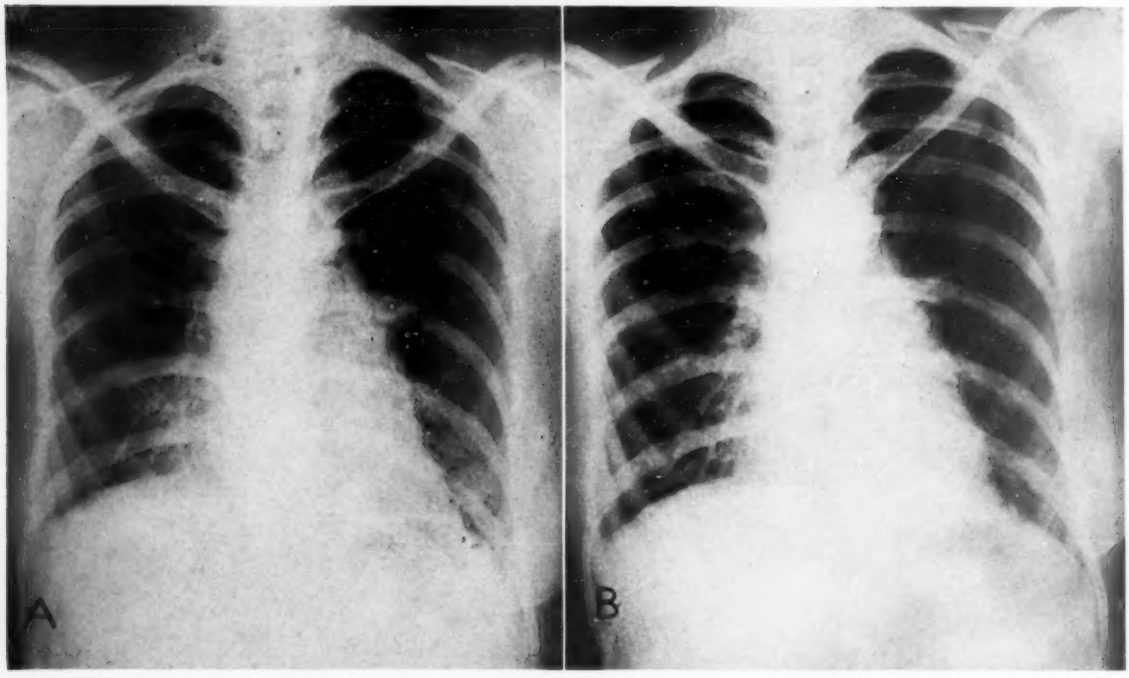


FIG. 6. Case III. (*A*) January 30, 1948. Hodgkin's disease infiltrates in left lung base. (*B*) August 4, 1948. Regression after nitrogen mustard therapy.

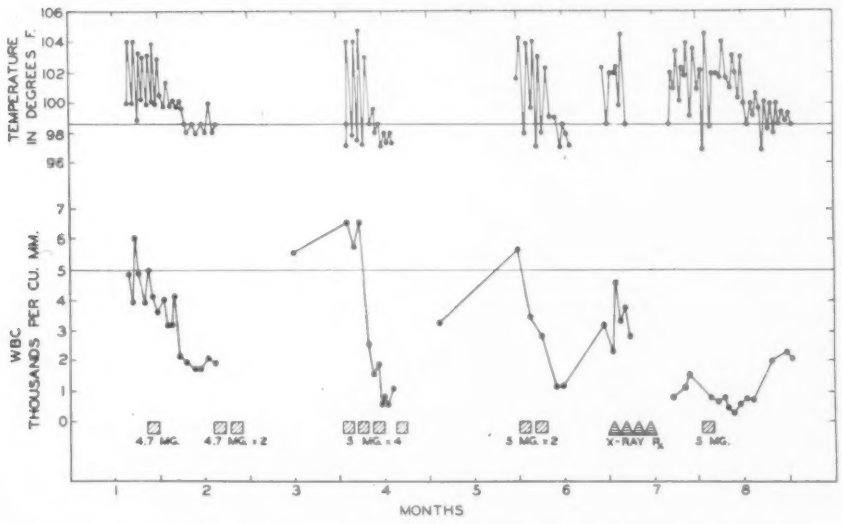


Chart 1. Temperature response and leukocyte changes in a patient with Hodgkin's disease treated with nitrogen mustard (HN2) in varying doses and roengten therapy over a period of eight months.

proved of greatest value in three types of cases. (1) In patients with moderately advanced forms of the disease, who are still responding favorably to roentgen therapy, the use of nitrogen mustard at suitable intervals between courses of roentgen therapy may control the activity of the disease more effectively than roentgen therapy alone, and the risk of serious radiation injury to healthy tissue may thereby be reduced. (2) In patients with extensive visceral, and particularly abdominal involvement, nitrogen mustard, because of its widespread distribution and selective action, is often strikingly beneficial. (3) In patients with chronic, slowly progressive disease who, as a result of much radiation therapy, have developed tissue necrosis or pulmonary

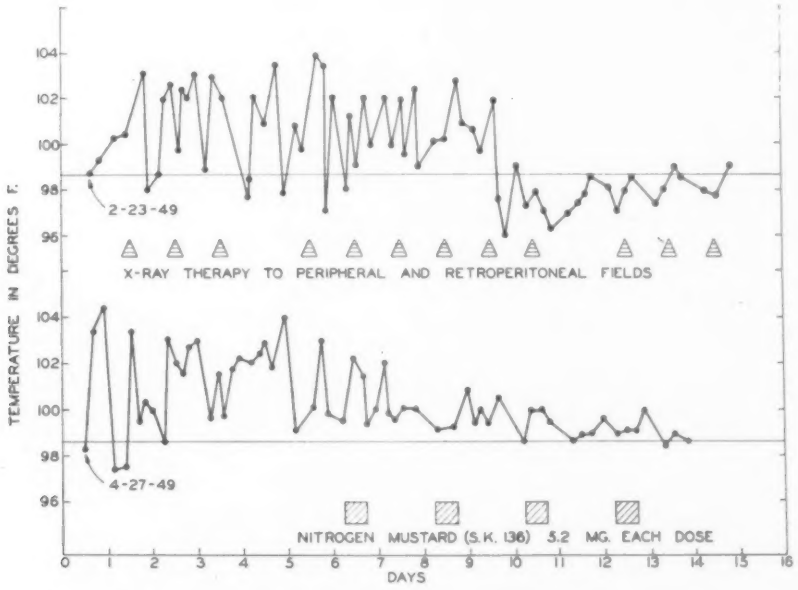


Chart 11. Temperature response to irradiation and subsequently to nitrogen mustard therapy in a patient with advanced generalized Hodgkin's disease.

fibrosis, nitrogen mustard may be the only effective form of therapy available.

There are certain other indications for the use of nitrogen mustard, the results of which may be of limited importance in the evaluation of these compounds as a major therapeutic contribution, but of possible real significance in the management of individual patients. In patients who have become refractory to roentgen therapy, nitrogen mustard in addition to providing symptomatic relief, may occasionally restore the ability of the individual to respond favorably to roentgen therapy. Patients with severe pruritus and those suffering pain due to nervous system involvement may obtain greater relief from nitrogen mustard than from roentgen therapy. Patients with acute, rapidly progressive or terminal widely disseminated Hodgkin's disease may be made more comfortable without materially influencing the course of their disease.

There are few contraindications to the use of nitrogen mustard in the treatment of Hodgkin's disease. In the presence of extensive bone marrow involvement with leukopenia, thrombocytopenia and severe anemia, the drug should be given in doses somewhat less than the usual amount of 0.1 mg. per kilo of body weight, and the intervals between injections should be lengthened to three or four days instead of the customary method of administering the material on alternate days until four treatments have been given. It should be emphasized, however, that leukopenia, even of profound degree, is not a contraindication to nitrogen mustard therapy, unless the depression of the leukocyte count is attributable to prior therapy. In the presence of jaundice or other evidences of hepatocellular dysfunction, nitrogen mustard should be avoided or given with great caution, because of the likelihood of its producing further liver damage.[4]

SUMMARY AND CONCLUSIONS

A series of 173 cases of Hodgkin's disease has been studied with reference to therapy and the factors influencing the length of survival.

Of the more common physical signs, enlargement of the spleen early in the clinical course of the disease is considered of most unfavorable prognostic significance.

The presence of a leukocyte count below 6,000 per cu. mm. is usually an indication of poor prognosis, although patients with leukocyte levels above 10,000 per cu. mm. also tend to succumb to their disease sooner than those with normal leukocyte counts.

Roentgen irradiation is the most satisfactory form of therapy in localized and early cases of Hodgkin's disease. It should be given energetically to all regions of the body in which there is evidence of involvement and should be repeated whenever there is evidence of local recurrences.

Nitrogen mustard is of especial value in the treatment of advanced cases of Hodgkin's disease, those with extensive visceral involvement, and those in which post-irradiation tissue damage is present or anticipated.

The use of alternate courses of roentgen irradiation and nitrogen mustard therapy has distinct promise in the management of Hodgkin's disease.

Because of its depressing effect on normal bone marrow, nitrogen mustard should always be given with caution and realization of its potential danger. Nevertheless, the contraindications to its use are few.

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DISCUSSION

Dr. Joseph L. Morton (in Dr. Herman A. Hoster's absence), Columbus, Ohio. The discussion which I wish to present is in accord with that planned by my associate, Dr. Hoster, who is unable to be present today. As radiotherapists we are impressed by the need in Hodgkin's disease, probably more than in any other field, for cooperation with the clinician.

In general, roentgen therapy in Hodgkin's disease is divided into two categories, local palliative and local curative therapy. By curative we mean no recurrence of disease in an area during the subsequent course of the illness. The question of local curability in a given area depends on three things: the stage of the disease, the inherent ability of the patient to respond to roentgen irradiation and the total roentgen-ray dose given. We do not think that less than 2,000 roentgens tumor dose will ever insure curability. With respect to the subsequent tendency of the disease to be concentrated in the same area or areas other than the local area treated, in general I think that one must consider that recurrences are going to be in the neighborhood of the initial site of adenopathy, particularly in the early cases. Plan for these recurrences along the lymphatic channels contiguous to the treated area and consider skin, bone marrow and other factors in order to prevent cases that are called "radiation resistant." In our experience, the primary problem is that we have no more skin tolerance left and the bone marrow is no longer capable of producing sufficient cells for survival.

Advances in the radiation therapy of Hodgkin's disease have been limited, to a great extent, by one factor. That is the inability to localize the disease for purposes of therapy within the abdominal cavity. Until this can be overcome, and a suitable method of treating the liver and spleen devised, treatment of Hodgkin's disease will remain as haphazard and as ineffective as it is at the present time. The importance of realizing that pain is as important an indication for therapy as the presence of a mass is apparently not appreciated by many of those who care for this type of patient. The importance of establishing the origin of the pain from the neurological point of view is almost wholly disregarded by many who come in contact with this disease. We find we are referring more and more patients with pain back to the neurologists for an opinion

in order that more accurate localization of the origin of the pain may be achieved. Furthermore, investigation of the hematologic equilibrium in Hodgkin's disease has been limited in most cases to an attempt to decide whether the circulating formed elements of the blood reflect a depression of the bone marrow and reticuloendothelial system making further therapy inadvisable. Evidence of exacerbation and increase in disease activity are often demonstrable only by means of changes in sedimentation rate, M/L ratio, leukocyte count, and certain other hematologic studies. This is especially true during the early and intermediate stages of disease.

From the point of view of palliation and prolongation of life, in most but not all cases, the value of roentgen therapy and nitrogen mustard therapy cannot be questioned.

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THE EXPERIMENTAL APPLICATION OF RADIOACTIVE COLLOIDAL GOLD IN THE TREATMENT OF PELVIC CANCER*†

By ALFRED I. SHERMAN, M.D., JAMES F. NOLAN, M.D., *and* WILLARD M. ALLEN, M.D.
ST. LOUIS, MISSOURI

THE anatomical and pathological characteristics of carcinoma of the uterus, both cervical and endometrial, limit the efficiency of the surgical and radiological therapeutic measures. The results of treatment are poor in cases where the tumors have spread beyond the areas accessible for surgical excision or beyond the effective range of irradiation.[12,13,19] To be sure, there have been many refinements in techniques of both surgical and radiation treatments, but with only limited success in over-all results. Emphasis has been placed upon the supposition that further advancement in the results of treatment of uterine cancers may be obtained by the development of better methods to destroy carcinoma in the parametria or regional lymph nodes. The aim of this study has been to investigate the potentialities of radiogold in colloidal form in the treatment of carcinoma of the uterus with attention directed toward its effects in the fields of lymphatic drainage.

Radioactive isotopes such as manganese, phosphorus, iodine, chromium, and gold have been used in treating malignant tumors.[8,9,18,21] Some of the approaches have been made upon the chemical characteristics of the element; some upon their affinity for specific cellular systems and some upon their selective concentration in cells of the reticulo-endothelial system. Recently the use of artificial radioactive materials as a direct local treatment has been demonstrated. For example, the beta activity of P^{32} in colloidal form as chromic phosphate has been utilized in treating transplanted mammary carcinoma in mice.[1] In addition Hahn *et al.*[5] have used local injection of radiogold in colloidal form in lymphomas and carcinomatous tumors in human subjects.

The problem of qualification of radiogold as a mode of treatment for carcinoma of the uterus was approached in the following four major studies: (*A*) The effect of radioactive gold in the treatment of squamous cell carcinoma in mice by direct injection.

(*B*) The effect of radiogold in colloidal form upon the parametria and pelvic lymphatics in rabbits after local infiltration.

(*C*) The effect of intrauterine application of radioactive gold in the rabbit.

(*D*) The tolerance levels for normal tissues in the parametria of the rabbit.

(*A*) In the first experiments, mice from four to six weeks in age were used. A squamous cell carcinoma, obtained from a previously induced tumor was transplanted subcutaneously in the right axilla of each animal.* These transplants were allowed to grow to sizes of from 0.4 cm. to 3.5 cm. in diameter.

Radioactive gold was obtained in colloidal form from a commercial source.** Au^{198} has the following physical characteristics: a half-life of 2.7 days; a beta radiation of 0.8 mev. and two gammas of 0.44 and 0.28 mev. The chemical characteristics of the colloid are: a particulate gold sol suspended in gelatin solution of pH 7–8. The particles are uniform spheroids of 200 millimicrons in diameter.[20] This was

* The tumors and mice were kindly supplied by the Department of Anatomy, Washington University Medical School, and are those in standard use in that department.

** The gold was purchased from Abbott Laboratories, North Chicago, Illinois.

* From the Department of Obstetrics and Gynecology, Washington University School of Medicine, St. Louis, Missouri. Presented at the Thirty-first Annual Meeting, American Radium Society, Atlantic City, N. J., June 5–7, 1949.

† The work was performed under a grant from the Atomic Energy Commission under the direction of the Office of Naval Research.

injected in and around the transplanted tumors. The technique of injection utilized a tuberculin syringe of the Hingson type and a 23 gauge needle. The injections were made at the tumor edge, spreading the material over the entire periphery. In the larger tumors, the gold was also introduced throughout the center of the tumor. This technique allowed as many point sources of radiation as possible to be spread throughout the entire tumor mass. It was found that the colloidal gold alone would leak from the puncture point in the skin. Also it would be absorbed into the general circulation from the site of injection. To overcome these disadvantages the gold was suspended in 1 per cent pectin solution in 5 per cent aqueous dextrose.[14] The amount of pectin solution added was determined by the dilution of the gold desired. With a little agitation a uniformly distributed gold suspension was obtained.

Measurements of radioactivity were made by a bell type thin mica window Geiger tube connected to an automatic counting device. Such assays were made after complete ashing of tissues and calculated in arbitrary counts per minute per 100 mg. of fresh tissue. The gold-pectin suspensions permitted the use of a greater dosage at the tumor site without increasing the circulatory dosage (Table 1).

In order to evaluate the cancerocidal effect of this material it was necessary to calculate the actual dosages delivered. It has been demonstrated that doses delivered by radioactive isotopes can be determined according to their concentration per unit volume of tissue.[10,11] In order to estimate the volume of the experimental tumors in vivo the formula $1/2 \times D^3$ was used where D represents diameter of the tumor. It was found that this estimated figure closely approximated the true tumor volume as measured by the water displacement method after excision. Therefore the doses were expressed as microcuries per cubic centimeter of tumor tissue based on these calculated volumes.

Criteria used in the evaluation of effectiveness of the solution were the following: Failure of treatment was defined as the death of the animal or the recurrence of the tumor; cure was interpreted as complete regression of the tumor without evidence of recurrence after a period of sixty days.

TABLE I

RELATIVE ACTIVITY AS DETERMINED BY NUMBER OF COUNTS PER MINUTE IN 100 MG. OF FRESH TISSUE

Organ Assayed	48 hours	48 hours	7 days	2 weeks	2 weeks
Tumor	100,000	100,000	100,000	100,000	100,000
Spleen	58	34	313	530	417
Liver	387	512	48	44	33
Kidney	50	84	32	25	27
Blood	32	60	4	2	3

There were 42 control animals; 16 received no treatment; 8 received inactive gold colloid; 8 received pectin solution alone; and 10 received a solution of inactive gold with pectin. No significant differences appeared in these animals or tumors. Death occurred in all cases within forty days of the date of selection.

The upper limits of tolerance for total body irradiation are shown by the fact that all animals (whether tumor bearing or not) which received more than 2 millicuries, died of over-irradiation. Moreover, none of the tumor bearing animals which received more than 1.5 millicuries survived. This is illustrated in Figure 1. There were 42 such tumor bearing animals and 10 without tumors. These animals became weak within seventy-two hours and had some diarrhea.

Some that survived for longer periods became quite cachetic and showed epilation. Death usually occurred in the first two weeks after injection. On necropsy examination, there was gross and microscopic evidence of damage to both liver and spleen.

The level of tolerance imposed by the biologic characteristics of the tumor itself is seen in Figure 2. The animals whose tumors were larger than 2 centimeters in diameter, or approximately 4 cubic centimeters in volume, did not respond, regardless of type of treatment. A tumor of

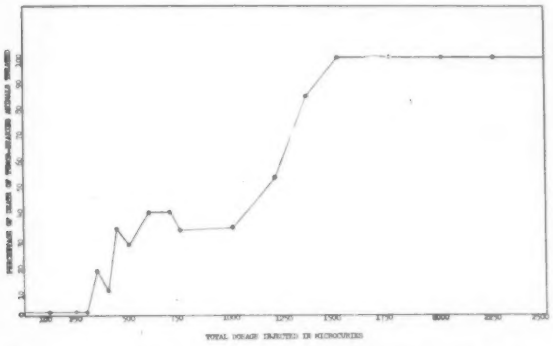

Fig. 1. Graphic illustration of lethal effect of radioactive gold with increased dosage in mice.

that size represented a large proportion of the entire animal. These growths were badly ulcerated and their hosts apparently died of infection and toxemia associated with necrosis of the neoplasm. There were 28 such animals treated with less than 1.5 millicuries of gold. They all died, presumably of progression of tumor growth. However, the amount of gold that these animals could be given safely fell below the required tumor control level in 75 per cent of the cases. Therefore, it would appear that some of these animals were actually undertreated. However, there were 29 animals with tumors varying from 1 to 2 cc. in volume, which received doses varying from 400 to 600 microcuries per cubic centimeter of tumor, and a total dose below 1.5 millicuries. These animals died showing no active tumor. The areas of injection became ulcerated and infected; the animals

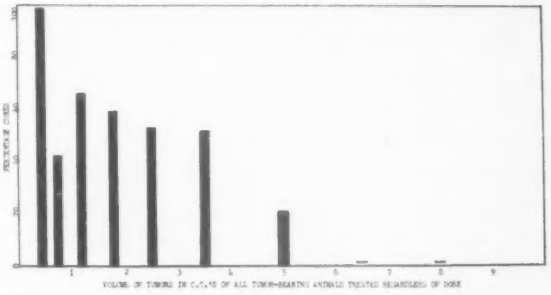

Fig. 2. Illustration of effect of volume of tumor upon result of treatment in squamous cell carcinoma in mice.

weakened and died of toxemia associated with massive breakdown of tissue and infection due to local over-irradiation.

Within the limits of biologic tolerance outlined in the foregoing experiments, there were 204 tumor bearing animals treated. Figure 3 illustrates that the best cure rate occurred with doses of 200 to 300 microcuries per cubic centimeter of tumor tissue. Beyond the dose of 400 microcuries and below 100 microcuries per cubic centimeter the results were poor.

It was observed that in the process of healing, the tumors of medium size usually hardened and left marked keratin formations at the site of the tumor. The larger tumors often ulcerated and became encrusted. Under the eschar there was regrowth of epithelium. The small tumors gradually regressed leaving normal skin

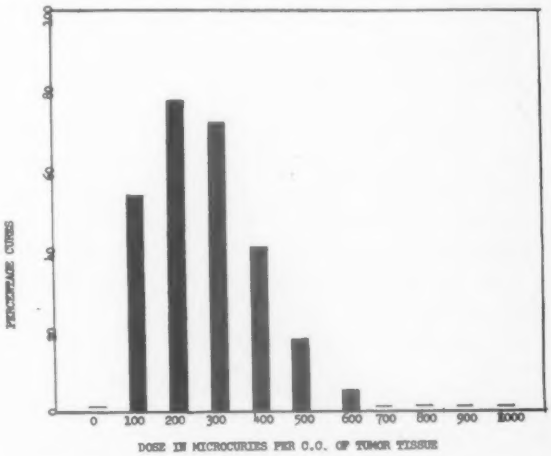

Fig. 3. The results of treatment with varying dosages per volume of tumor tissue.

tissue discolored by the gold. If there was not excessive scar tissue, hair grew back over the affected areas. On microscopic examination there was marked keratin formation overlying the epithelium, and abundant scar tissue beneath it. Gold particles which remained in situ were easily detected. In these animals there was no microscopic evidence of damage to the distant organs. One mouse bore a litter of seven, two months after treatment.

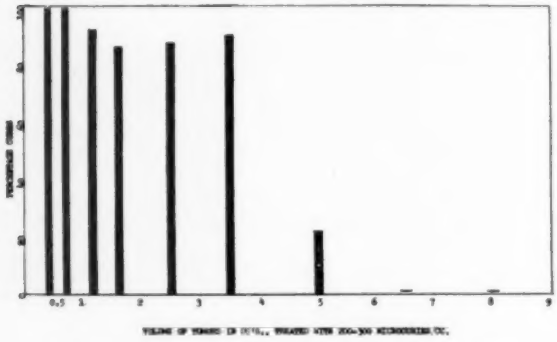

FIG. 4. Illustration of the effects of optimum dosage in relation to volume of tumor.

In Figure 4 the percentage of cures in the animals treated with 200 and 300 microcuries are shown in relation to the total volume of their tumors. With tumors 1 cc. in volume or less the cure rate was 100 per cent. In animals with tumors varying from 1 to 4 cc., the cure rate varied from 86 to 92 per cent. When tumors exceeded 4 cc. in volume, the results were significantly poor.

Table II illustrates the failures in the treated group. The failures which were due to recurrences were all in the group treated with 100 microcuries per cubic centimeter, whereas 88 per cent of the total failures due to death of the host occurred in the group treated with 300 to 400 microcuries per cubic centimeter. Forty-eight per cent of the recurrences in the group treated with 100 microcuries were cured when they were retreated with additional gold, provided the total dose remained below 1.5 millicuries.

It was thought that under direct visualization of the tumor, multiple small injections would make it possible to treat areas which seemed to be recurring, or not regressing satisfactorily. Therefore, 33 tumors were treated by administering 50 to 100 microcuries of gold at each injection over a period of ten to fourteen days for a total of three to six injections. There was no improvement in results with this method of therapy as compared to the single injections.

By using the formula published by Marinelli, Quimby and Hines,[10,11] it was estimated that the radioactivity of 100 microcuries of gold per gram of tissue would be approximately 7,625 roentgens. It can be estimated from the work of several investigators[4,6,16] that in the treatment of squamous cell carcinoma of the uterine cervix, 7,000 to 15,000 equivalent roentgens are in the safe tumor controlling range. Dosages above 25,000 equivalent roentgens are in the range which produces severe necrosis. The results in this study tend to concur with these figures.

(*B*) Female rabbits ranging in size from 2,600 to 4,000 grams were used in the following experiments to study the effect of the direct injection of radioactive colloidal gold into the parametrium. The gold was prepared, as previously, in the form of a colloidal suspension in pectin solution. Radioactive measurements were performed as previously described. Under direct visualization through an abdominal incision, the radioactive gold was injected into the parametria of the rabbits. Amounts of gold ranging from 1 millicurie to 25 millicuries were injected into various volumes of

TABLE II

Dose in Microcuries per cc. of Tumor Tissue	Deaths		Recurrences	
	Total 18	Per Cent	Total 9	Per Cent
100	0		9	100
200	2	11	0	
300	6	33	0	
400	10	55	0	

parametrial tissue. At different time intervals after injection, the animals were again opened. Biopsies were taken from lymph nodes and other organs, for radioactive assay, and for microscopic study.

The earliest reoperations were performed at seventy-two hours. It was found that the lymphatic vessels were increased in number and were filled with phagocytic cells. In some instances, the lymph channels were plugged with these scavenger cells. The cells included large mononuclears, polymorphonuclears, lymphocytes, and giant cell types. The gold particles were contained in their cytoplasm. In the parametria of rabbits there are many small lymph follicles which drain the lymph vessels. It was found that these follicles were most affected. They were found to be enlarged and palpable. On microscopic examination scavenger cells could be seen entering these follicles by way of the lymph vessels. There were many gold particles seen in these areas accompanied by marked cellular destruction. Seven days after injection, an even greater proportion of the injected gold was found in the cytoplasm of the scavenger cells. At this time considerable amounts of gold were found in the iliac lymph nodes accompanied by marked radiation damage. Cystoplasmic edema, loss of cell outline, and nuclear disintegration were present. Somewhat less damage was noted in the hypogastric group of nodes. Six weeks after the injection there was still marked evidence of damage to the iliac nodes, but in some instances lymphocytic cells were seen about the larger blood vessels. These may represent new germinal centers and regeneration. At three months the injected area and its immediate surroundings showed marked fibrosis and atrophy of the normal cellular structures. The lymphatics were lined with gold particles and were involved in the fibrotic activity.

The animals withstood these operative procedures without difficulty. Both gross and microscopic examinations revealed no untoward irradiation effects, either locally, or in distant organs. Only a minimal amount of the total injected gold found its way into the general circulation (Table III).

Another mode of administration consisted of direct injection of colloidal gold into the free peritoneal cavity. Four millicuries of gold pectin suspension were injected into the peritoneal cavity through the anterior abdominal wall in 4 animals. No evidence of radioactivity could be determined in the blood for as long as two weeks, at which time the animals were sacrificed and autopsied. Radioactive assays of liver and spleen were negative, but gold was found in the retroperitoneal lymph nodes. Microscopic examination showed definite irradiation effects in these nodes. No damage to the abdominal contents was noted.

In 6 animals, oxycel gauze impregnated with radioactive gold pectin solution was wrapped about the uterine horns. In 1 other animal it was wrapped about the

TABLE III

RELATIVE DISTRIBUTION OF RADIOACTIVITY AS DETERMINED BY ASSAY OF FRESH BIOPSIED TISSUE. FIGURES ARE ARBITRARY UNITS AS DETERMINED BY NUMBER OF COUNTS PER MINUTE PER 100 MG. OF TISSUE

Organs	Rabbit 1 9 Days	Rabbit 2 16 Days	Rabbit 3 22 Days	Rabbit 4 35 Days
Parametrium	100,000	100,000	100,000	100,000
Spleen	313	408	17	158
Liver	36	19	9	42
Kidney	30	23	0	0
Blood	32	18	0	0

great vessels. The doses ranged up to 1 millicurie per square centimeter of gauze. Six weeks later the animals were sacrificed and necropsied. There was marked fibrosis at the areas of treatment. Many anterior and posterior retroperitoneal lymph nodes were enlarged and necrotic. Assay of the various organs revealed only minimal activity compared to treated areas, but lymph nodes had definite gold deposits.

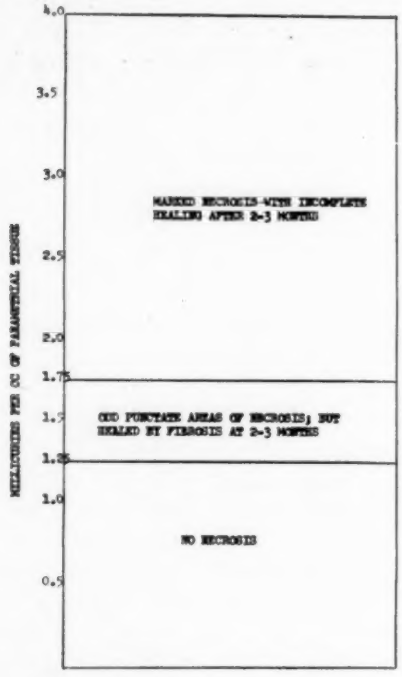

FIG. 5. Illustration of tolerance levels of normal parametrial tissue in the rabbit.

Microscopically, there was an abundance of scar tissue with a minimum of necrosis at the treated areas. The lymph nodes showed definite necrosis. The animals withstood these procedures without any evident complications.

(*C*) The value of the preoperative radiation therapy by the intrauterine application of multiple radium capsules in the treatment of carcinoma of the corpus uteri has been well demonstrated by the work of Heyman and Benner,[7] and others.[3] Furthermore, dosage measurements have shown that the field of irradiation can be made more effective by adding as many small sources as possible.[17] This effectiveness increases because the increased uniformity of the fields decreases the discrepancy between minimum and maximum doses, hence allowing greater exposures with more safety. Second, it allows the closer approximation of sources about a tumor in an attempt to deliver an adequate dose by crossfire. By this technical improvement in radium therapy, more effective eradication of endometrial cancer is expected.

An ideal method to obtain maximum technical improvement in both uniformity and thoroughness of exposure seems to be

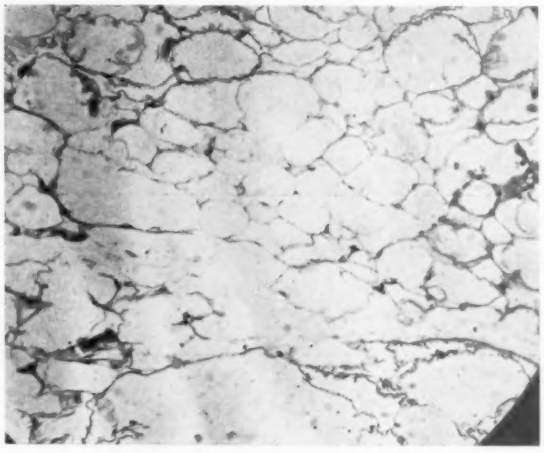

FIG. 6. Photomicrograph of normal rabbit parametrium.

in the introduction of a radioactive fluid into the uterine cavity, to irradiate all areas equally, even where bulky tumors or myomas distort the cavity. It was therefore decided to study the effect of radioactive gold in colloidal pectin suspension in the uterine cavity. In the absence of available endometrial cancers in larger experimental animals, it was decided to approach the problem in the following manner.

The effect of endocrine stimulation on the endometrium in the rabbit has been well illustrated by W. M. Allen.[2] The ovarian hormones give an immediate proliferative response on the part of the endometrium with rapid growth and mitotic activity. This fact lends itself to the study undertaken. Mature female rabbits weigh-

ing 3,000 to 4,000 grams were used in these experiments. The intrauterine injections were performed through abdominal incisions, tying off the horns at the level of the cervix to prevent escape of the solution.

In the control animals inactive colloidal gold in a pectin solution was introduced into one horn and pectin solution alone into the other. Simultaneously 200 International Units of chorionic gonadotrophin* were administered to the animal. In other animals, different dosages of 1, 5, 10, 15, and 20 millicuries of radioactive gold were injected into the cavity on one side while a similar amount of inactive gold in pectin solution was introduced in the opposite horn. The concentrations of activity were

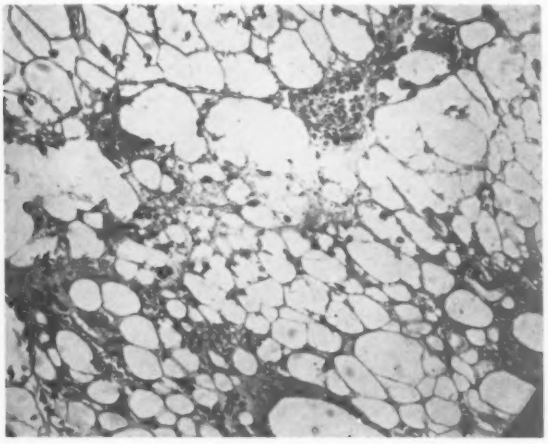

Fig. 7. Low power study of parametrial tissue after injection with colloidal Au^{198}.

such that the 1 and 5 millicurie doses were in a volume of 5 cc., whereas the 10, 15, and 20 millicurie doses were in 10 cc. volumes. These animals also received 200 International Units of gonadotrophin simultaneously.

At seven days the animals were again opened and biopsies taken from both horns. Four weeks later biopsies of both horns were repeated and the animals were again stimulated with chorionic gonadotrophin. However, no further gold injections were given. Seven days later the animals were

* Korotrin was kindly supplied by the Winthrop Chemical Company.

Fig. 8. Microincineration of tissue in Figure 7.

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With the first stimulation it was found that in every control case (the horn containing inactive gold) the uterus responded by a marked prolific progestational effect in the typical manner. However, in the opposite horn which contained the radioactive gold no progestational effect could be detected throughout the whole length of the horn. In addition, typical irradiation effects could be seen in these tissues. The ovaries on both sides responded in the normal manner showing marked follicle stimulation with corpora lutea formations.

At four weeks the control horns had returned to the normal resting stage, but the opposite horns showed atrophy and definite irradiation effects. A repeated stimulation at this time without further gold injections again caused the control horn to respond, whereas the opposite horns again failed to respond.

With the second stimulation, the ovary on the same side of the horn which contained radioactive gold failed to respond in an equivalent degree to the opposite ovary. The number of developing follicles was markedly decreased and only one corpus luteum was noted on microscopic examination. This demonstrates that the radiation exposure was of such magnitude as to cause irradiation effects in the adjacent ovary.

The animals withstood these procedures

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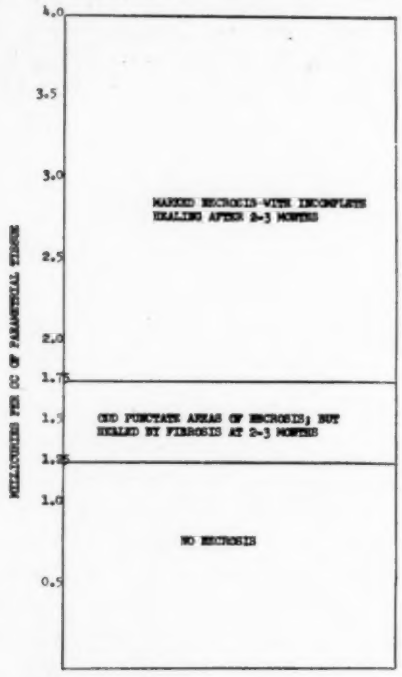

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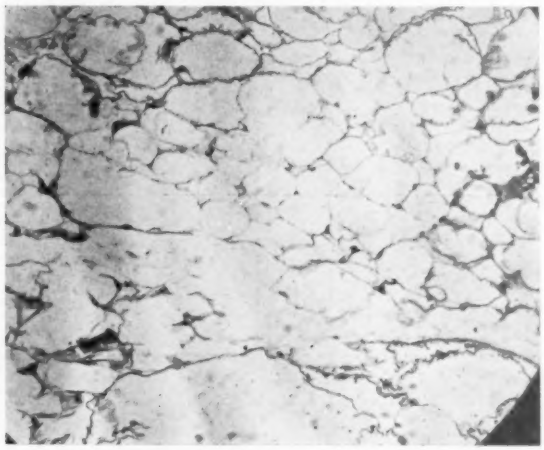

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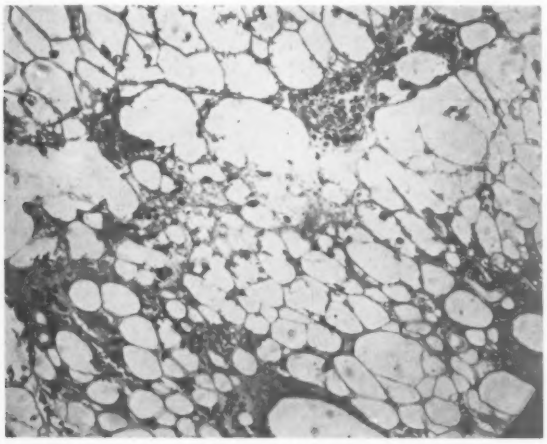

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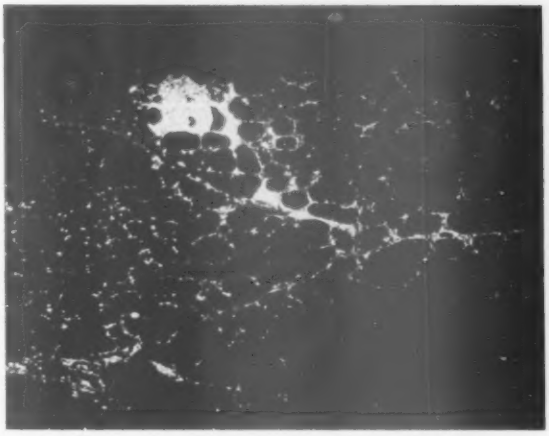

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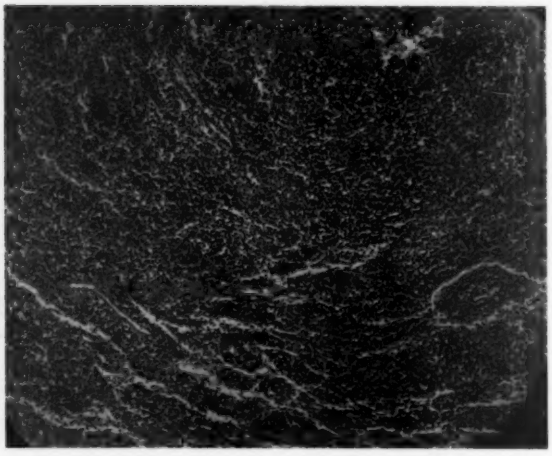

FIG. 9. Normal lymph node in rabbit.

without difficulty. The irradiation effects noted were chiefly confined to the endometrium, but were correspondingly more extensive as the dose was increased from 1 to 20 millicuries. The highest concentration used was 2 millicuries per cubic centimeter of solution. No necrosis resulted from this dose.

It was also noted that, when the animals were examined the second time, there had been complete absorption of the injected solution. No intraperitoneal spill of the gold could be detected. The lymphatics in the submucosa and subperitoneal tissue contained phagocytes with ingested gold particles. There were local irradiation effects wherever the gold particles were present.

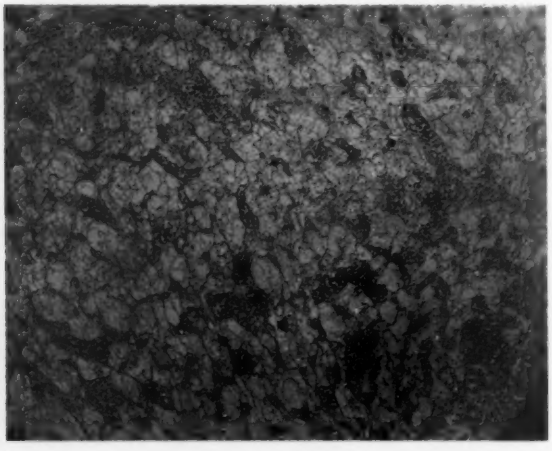

FIG. 10. Lymph node destroyed by phagocytosed particles of radiogold nine days after injection.

On microscopic examination of the iliac and hypogastric lymph nodes, gold particles in large numbers were found situated throughout most of the glands and definite areas of lymphocytic destruction were evident. No untoward irradiation effects could be demonstrated in any of the other local or distant organs on both gross and microscopic examination.

(*D*) In order to obtain a relative idea of the tolerance level for parametrial tissue using interstitial injections of radioactive gold, it was decided to use the rabbit for study. On comparing the histology of the rabbit's parametrium to that of the adult human female, it is found that the rabbit has a great deal more fat and less connective tissue. However, both contain the large blood vessels supplying the corpus and cervix, and are anatomically comparable as to the course of the ureter.

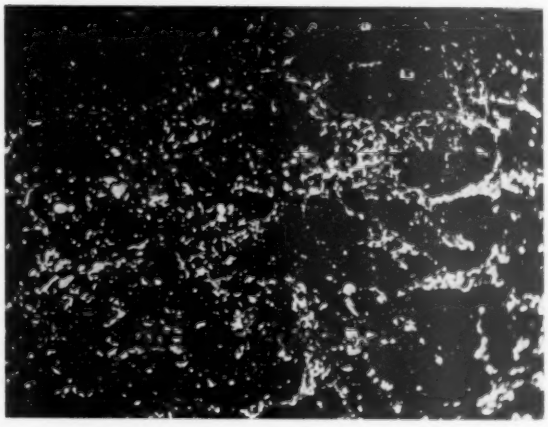

FIG. 11. Microincineration showing distribution of colloidal gold in lymph node.

Female rabbits varying in size from 2,000 to 4,000 grams were injected with various amounts of gold, ranging from 1 to 25 millicuries into various volumes of parametrial tissue. The injections were administered directly into the parametria of the rabbits under direct visualization through abdominal incisions. The volumes of the tissues injected were measured and the

gold distributed evenly throughout the entire volume. To standardize the calculations, dosages are expressed as millicuries per cubic centimeter of tissue injected. The amounts injected were such that the concentrations of radioactivity per cubic centimeter of parametrial tissue were as follows: 0.25, 0.4, 0.5, 0.67, 1.0, 1.25, 1.5, 1.75, 2.0, 2.5, 3.0, and 3.5 millicuries. At least 2 animals were used for each concentration and as many as 4 in some cases.

The animals were biopsied or sacrificed as necessary at various time intervals after injection. The tissues were studied for degree of necrosis, fibrosis, and recovery.

It was found, as illustrated in Figure 5, that with doses up to 1.25 millicuries per cubic centimeter, no adverse damage was noted. From 1.25 to 1.75 millicuries per cubic centimeter occasional punctate areas of necrosis were noted at two weeks. These were accompanied by extensive fibrotic activity and were found to be entirely healed by two to three months. Beyond that dose there was marked necrosis, and although marked fibrosis was present there was still extensive necrosis after two to three months in all cases examined at that time.

In some animals oxycel gauze impregnated with radioactive gold in colloidal pectin suspension was wrapped about the uterine horns, larger blood vessels, and ureters. With 1 millicurie per square centimeter of uterus there was no evident necrosis. In doses up to 1.5 millicuries per square centimeter there was no damage to the blood vessels although marked perivascular fibrosis was present. With a dose of 1.5 millicuries per square centimeter there was enough periureteral fibrosis to cause partial ureteral constriction as evidenced by ureteral dilatation above the treated area. With the intrauterine applications of radioactive gold, doses up to 2 millicuries per

Fig. 12. Normal progestational response in uterine horn of rabbit.

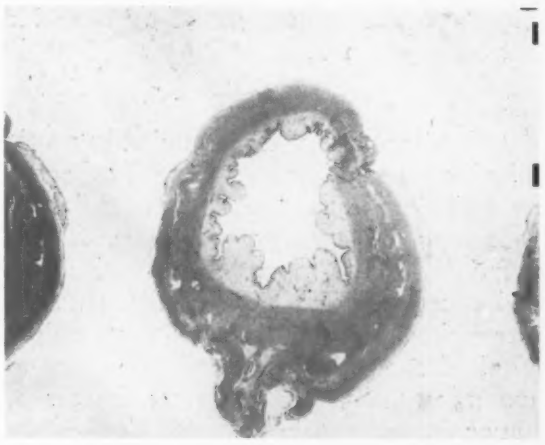

Fig. 13. Destruction of uterine mucosa by instilled Au^{198} in colloidal form which does not respond to stimulation.

Fig. 14. High power photomicrograph of irradiated endometrium.

cubic centimeter of injected solution did not cause necrosis.

SUMMARY

1. Radioactive gold suspended in pectin solution was used as an interstitial therapy method, in the treatment of transplanted squamous cell carcinoma in mice. It was found that these tumors could be safely and completely cured, with high survival rates using this therapy. The optimum dose required for cure was found to be 200 to 300 microcuries per cubic centimeter of tumor tissue.

2. Radioactive gold in colloidal pectin suspension was injected into the paracervical tissue of rabbits. It was found that the gold entered the lymphatic system and reached the primary and secondary regional lymph nodes. There were definite irradiation effects noted in these areas. Radioactive gold when injected into the peritoneal space found its way into the retroperitoneal lymph nodes causing marked irradiation effects.

3. Radioactive gold in pectin solution was introduced into the uterine horns of rabbits and left in situ. In the presence of this material the usual progestational response with rapid growth and mitoses resulting from stimulation with chorionic gonadotrophin was inhibited. The range of irradiation included the ovaries which also showed irradiation effects. The normal tissue responsiveness had not returned after six weeks. The gold was also found phagocytosed and carried to the lymphatics of the submucosal and subperitoneal tissues and to the immediate lymph nodes draining these areas.

4. During the experiments with radioactive gold it became necessary to study and define tissue tolerance levels by this form of radiation therapy. The tissue selected for study was the parametrium of the rabbit. The results indicate that doses of radiogold at therapeutic levels are not injurious to normal structures.

5. The results of these experiments in lower animals qualify the effectiveness and limitations of radioactive colloidal gold in pectin solution as a mode of treatment in carcinoma of the uterus. The physical characteristics of the material and its behavior in relation to biologic processes suggest its use as an adjunct to present methods of radiation therapy in this disease.

The authors wish to express their appreciation to Dr. A. I. Lansing and his associates in the Department of Anatomy, Washington University School of Medicine, St. Louis, Missouri, for their aid and cooperation in this study.

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RADIUM THERAPY OF PRIMARY CARCINOMA AND OTHER MALIGNANT LESIONS OF THE VAGINA*†

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PRIMARY malignancy of the vagina is a rare condition. Approximately 0.5 per cent of all carcinomas of women are said to be of vaginal origin and from 1 to 2 per cent of all malignant neoplasms of the female genital tract are primary in the vagina. Prior to 1920 only isolated case reports were present in the literature and many of these were descriptions of growths secondarily involving the vagina. Stacy, in 1922, found only three previous reports in the American literature on primary carcinoma of the vagina. Since that time there have been an increasing number of analyses of data from the larger clinics. The treatment of the condition has always been a vexing problem. The early radical operation of Wertheim and Schauta offered little to the patient, since there was a 10 per cent operative mortality rate and 90 per cent early reccurrence rate.[7] Radium therapy and roentgen therapy are the accepted modes of treatment at the vast majority of therapeutic centers at the present time. Unfortunately the five year survival rate has remained very low. It is our purpose to present data on 50 cases of primary carcinoma or other malignant lesions of the vagina encountered at the Mayo Clinic from 1930 through 1948, to present our mode of therapy, to try to evaluate the problems connected with the treatment of these highly malignant conditions and to tabulate the five year end results of treatment.

The etiology of primary carcinoma of the vagina is unknown. Formerly trauma was felt to be of importance. Childbirth and the prolonged use of pessaries were implicated, but as in other malignant conditions trauma is no longer considered a primary etiologic agent. In the same fashion chronic inflammation was once felt to be concerned in the etiology but at the present time no single factor can be held responsible.

The diagnosis of primary carcinoma of the vagina is said, by many authors, to be simple. This may be true, but the differentiation of this condition from secondary involvement of the vagina by a malignant lesion arising elsewhere is often most difficult. A careful pelvic examination; adequate visualization of the lesion, which we have found is best afforded by the knee-chest position; and finally, biopsy and microscopic confirmation of the clinical impression are essential in making the diagnosis in any case. In the selection of cases for this review the criteria established by the League of Nations Health Organization, as modified in 1932, have been rigidly followed.[6] Namely, the site of the growth was in the vagina, clinical examination showed the cervix intact and there was no ground for supposing that the carcinoma was other than a primary growth in the vagina. In addition to this, in each case in our series the results of vaginal biopsy were positive and in many of our cases cervical biopsies were performed which were negative for malignancy.

The reasons for the poor end results from therapy are obvious. First, the lesion is seldom seen at an early stage. This should

* Presented at the Thirty-first Annual Meeting, American Radium Soceity, Atlantic City, N. J., June 5–7, 1949.
† Abridgment of a portion of the thesis to be submitted by Dr. Decker to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Obstetrics and Gynecology.

steadily decrease with the increasing prevalence of periodic physical examinations for women in the menopausal and postmenopausal age groups. Second, when the lesion is seen early it is often mistaken for a benign condition and either simple excision or cautery is performed without recourse to microscopic examination. Third, the anatomic structure of the vagina affords little resistance to direct extension of the malignant lesion and the rich lymphatic drainage gives an easy path for lymphatic spread. Finally, the rarity of the condition has prevented any one group of physicians from acquiring sufficient experience to standardize the treatment and to overcome completely the difficulties of applying radium to lesions in the lower part of the vagina.

Many methods have been devised to apply radium treatment, and the techniques of deep roentgen therapy also vary, but the survival rates are amazingly similar, as seen in Table 1.

The five year survival statistics would seem to prove without any doubt that primary carcinoma of the vagina is a highly malignant lesion and one very difficult to treat.

Moench[8] reported on 59 patients having primary vaginal carcinoma seen at the Mayo Clinic from 1904 to 1930. Fifty-three of these patients could be traced and, as shown in Table 1, only 9 patients survived from two to twelve years. The 53 patients include a group of 18 patients who had been previously reported on by Broders,[2] and who were treated by surgical measures alone. Twelve of Broders' patients were traced and 2 survived for five years. Moench stated that in her series of 12 cases which could be classified as "early," 6 patients survived at the time of her report, plus 1 survival in the group she classified as "advanced." She also mentioned that in the advanced cases the palliation afforded by radium and deep roentgen therapy allowed a longer average survival rate than in those in which surgical measures alone were used.

A sufficient period has elapsed since Moench's review to re-evaluate the end results of radium and roentgen therapy on patients with primary malignant lesions of the vagina seen at the Mayo Clinic.

In 42 of the 50 cases from 1930 through 1948, the lesions were squamous-cell epitheliomas. In 4 cases, adenocarcinomas

TABLE I

SURVIVAL RATES FOR PRIMARY CARCINOMA OF THE VAGINA

Source of Report	Total Patients	Patients Who Survived Three Years	Patients Who Survived Five Years or More
Lederman and Mayneord[7]			
Royal Cancer Hospital, London	7	2	1
Emmert[5]			
Barnard Hospital, St. Louis	26	*	4
Den Hoed[4]			
Netherlands Cancer Institute	21	*	7
Moench[8]	53†	9 patients survived 2 to 12 years	
Mayo Clinic, Rochester			
de Büben[3]			
First Gynecologic Clinic, Royal Hungarian University	28	*	2
Smith[10]			
Memorial Hospital, New York City	57	*	7

* Not stated.
† Traced patients.

TABLE II

AGE INCIDENCE: PRIMARY SQUAMOUS-CELL EPITHELIOMA OF THE VAGINA

Age, years	Cases
30–39	2
40–49	14
50–59	15
60–69	6
70–79	5
Average age: 54.4 years	

and, in 1 case each, leiomyosarcoma, melano-epithelioma, hemangio-endothelioma and lymphosarcoma were treated. The 42 cases of squamous-cell epithelioma will be analyzed as a group, and the remainder will be summarized as a separate group.

SQUAMOUS-CELL EPITHELIOMA

The average age of the patients with squamous-cell epithelioma was 54.4 years with an age range of thirty-eight to seventy-eight years. The distribution by decades is shown in Table II.

Thirty-seven patients were married or widowed and 5 were single. Twenty-five were parous and 17 were nulliparous. The anatomic location of the lesions is shown in Table III.

The average duration of symptoms before diagnosis in this group was 7.3 months, the range extending from three weeks to three years. The presenting symptoms are listed in Table IV.

The tumors were graded according to Broders' classification, 21 being graded 4, 15 graded 3, 6 graded 2 and no cases graded 1. Thus, in 36 of the 42 cases the lesions were of a high grade of malignancy microscopically. This again is consistent with the rapid growth of the tumor and the short survival time of the patient.

TABLE III

ANATOMIC LOCATION: PRIMARY SQUAMOUS-CELL EPITHELIOMA OF THE VAGINA

Location	Cases
Posterior vaginal wall	20
Anterior vaginal wall	7
Lateral vaginal wall	7
Region about the cervix	2
Entire vagina	5
Site unknown	1
Total	42

The purpose of any method of cancer therapy is to destroy the malignant lesion without compromising the adjacent healthy tissue. This, we felt, was best attained by local treatment of the vaginal lesion first, either by surface contact with radium applicators or by interstitial irradiation by radium needles or radon seeds. When there has been evident lymph node involvement, the nodes have been treated simultaneously with special applicators which will be described later. After this, almost all of our patients have had a course of roentgen therapy delivered over the pelvic areas. The total amount of therapy given by means of radium had depended, first, on the size of the vaginal canal and the body contour of the patient. As a general rule, lesions of the upper third of the vagina have been treated much like cancer of the cervix. In lesions of the lower two-thirds of the vagina the intrauterine tandem has often been omitted and more radiation has been applied directly to the lesion.

TABLE IV

PRESENTING SYMPTOM: PRIMARY SQUAMOUS-CELL EPITHELIOMA OF THE VAGINA

Symptom	Cases
Vaginal bleeding	19
Bloody and watery vaginal discharge	11
Watery vaginal discharge	7
Pain	2
Mass in right groin	1
Vaginal mass	1
Unknown	1
Total	42

Certain basic principles for the application of radium are in use at the Mayo Clinic. These have been described in detail elsewhere.[1]

The dosage and technique of treatment of cancer of the vaginal wall are difficult to describe because the variations in the lateral extent and depth of the lesions and the variations in the location of the lesions in the vaginal cavity make each case a separate study. Therefore no standardization of technique is possible. It is not difficult to destroy 90 per cent of the malignant tissue; the important factor is to destroy the entire growth with the least possible injury to the normal tissues surrounding the lesion. Probably the entire growth should receive 4,000 to 6,000 gamma roentgens over a period of one to two weeks. If the lesion is infiltrating, sufficient therapy may be given by covering all of it with plaques of radium tubes, as many as necessary to cover all the pathologic tissue 60 to 90 milligram hours per square centimeter being given. If the lesion is medullary, protruding into the vaginal cavity, further dosage is usually supplied with radium needles or seeds, in addition to the surface treatment, to yield sufficient gamma roentgens to the depth of the growth. In addition if the lesion of the vaginal wall is near the cervix, radium tubes are inserted into the cervical canal for substantial dosages. This seems desirable because these rapidly growing, high grade lesions tend to spread over the cervix and into the cervical canal. The applicator for direct contact with the lesion consists of two or three 1.0 mm. platinum-walled tubes containing 50 mg. of radium sulfate (element), encased with 2.0 mm. of Para rubber, strapped together side to side. The vaginal fornices are irradiated with an applicator consisting of a standard 50 mg. platinum tube encased in 1.0 cm. of Para rubber or bakelite, the whole covered with a rubber finger cot. The cervical applicator consists of the standard 50 mg. platinum tube, which either is used in the cervical canal or may be implanted directly into a necrotic tumor mass. The intrauterine tandem, if used, is usually made of two standard platinum tubes end-to-end enclosed in a 1 mm. brass sound. Radon seeds of 1.0 millicurie each may also be implanted in the tumor mass.

The intensive broken dose method of application has been used in all cases. This has allowed the individualization of cases which is essential in the proper treatment of these lesions. When lymph node involvement is present, radium at a distance has been used simultaneously with the local treatment of the lesion. The area to be treated is checkerboarded and the standard platinum tube at a distance of 2.5 cm. has been used.

This method of treatment requires hospitalization of the patient only for the day of treatment. Thus, the total time spent in the hospital is normally only eight to ten days, although the total time concerned may be ten to twenty-one days. An interval of one to seven days between treatments is usual, depending on the response of the lesion. The radium is applied with the patient in the knee-chest position. Excellent visualization of the lesion is obtained with the use of a Sims speculum since, with the admission of air, the vagina becomes a hollow distended organ. No anesthetic agent is necessary. The radium applicator may be easily and accurately placed without discomfort to the patient. Sterile gauze packing not only holds the applicator firmly in position but also keeps the adjacent tissues from contact with the applicator. As the treatment proceeds the gross changes occurring in the malignant tissue are readily observed and the treatment may be guided by the response.

Supplemental roentgen therapy is started a few days after completion of the radium therapy. Usually the pelvic area is divided into two anterior and two posterior ports, 16 by 16 cm. The factors used are 200 kv., 20 ma., 50 cm. distance, 20 minutes, with a filtration of approximately 0.75 mm. of copper and 1.0 mm. of aluminum; 500 r in air are delivered to each field. In some cases divided dosage may be used. If the lesion is extensive a second course of roentgen therapy is given three months later. Larger doses are not used because of the

possibility of irritation to the bladder or intestine.

All patients are instructed to return for re-examination every three to four months the first year, every six to nine months the second and third years and every year thereafter.

An illustrative case will best serve to demonstrate the method outlined.

CASE 1. A widowed white woman, aged fifty-three, had noted the onset of a puslike vaginal discharge and bright red vaginal spotting for approximately four months. For the previous ten years she had noted a slight brownish vaginal discharge but repeated pelvic examination had not revealed any abnormality. An examination at this time by the local physician disclosed a suspicious vaginal lesion and he referred her to the Mayo Clinic.

The patient's past history included right nephrectomy in 1927 for hydronephrosis. She had visited the Clinic on numerous occasions after this for nervousness, presbyopia and obesity. She had had one normal pregnancy and delivery. The menopause had occurred without incident three years prior to the present illness.

Physical examination revealed a moderately obese woman. The vaginal lesion was the only positive finding. This was described as a round, rosette-like growth on the posterior vaginal wall. Surrounding the lesion and involving the posterior half of the vaginal canal was a soft velvety friable growth. The cervix was not involved. Biopsy of the lesion showed grade 3 squamous-cell epithelioma. The results of laboratory examination of the blood and urine were not abnormal. The sedimentation rate was 25 mm. per hour (Westergren).

Radium therapy was started immediately. On the first day (March 13, 1947) a cervical applicator containing 50 mg. of radium sulfate (element) was inserted in the proximal portion of the cervix for six hours. At the same time a plaque of three standard platinum tubes with additional filtration of 2.0 mm. of Para rubber was applied directly to the lesion for two hours or approximately 55 milligram hours per square centimeter.

The second day (March 14) the plaque of three tubes was placed on the lesion without overlapping the area covered on the first day. It again was left in place two hours. After this the vaginal applicator, consisting of one standard 50 mg. tube with additional filtration of 1.0 cm. of Para rubber, was inserted in the right fornix and left for twelve hours.

Three days later (March 17) the vaginal applicator was placed in the left vaginal fornix for ten hours. The plaque had previously been placed for two hours on the remaining untreated portion of the lesion.

Three days later (March 20) a cervical applicator was placed in the midcervix for nine hours, or 450 milligram hours. And finally, four days later (March 24) an intrauterine tandem containing 100 mg. of radium sulfate (element) was inserted for ten hours or 1,000 milligram hours.

Therefore in five treatment days a total of 3,750 milligram hours was delivered to the lesion, the cervix, the uterine fundus and the adnexae.

Roentgen therapy was started three days after the completion of the radium therapy. The pelvic area was divided into two anterior and two posterior ports and one field was treated per day (March 27 to April 1), a total of four treatments. The factors used were 200 kv., filtration copper 0.75 mm. plus aluminum 1.0 mm., distance 50 cm., 20 ma., time 20 minutes (500 r measured in air).

The patient was then sent home. She returned in three months for examination. The vagina appeared smooth. There was some diminution in the size of the vaginal canal. Since the initial lesion had been extensive a second course of roentgen therapy was given. The patient returned again in three months complaining only of a very slight backache. The two posterior pelvic ports were again treated by roentgen therapy in February, 1948, four months after the last roentgen therapy. Subsequently, mild proctitis developed but responded quickly to conservative measures. The patient has been well since that time. A total of approximately 5,000 r in air was given in the three roentgen treatment periods.

Associated Surgical Procedures. All of the group of patients being reported were treated with radium or roentgen therapy or both. In only 7 cases was any surgical procedure performed. One patient had received roentgen therapy elsewhere, followed by vaginal hysterectomy in two months. The lesion when seen at the Clinic eleven months later showed massive extension. Palliative limited radium treatment and roentgen treatment were given. The

patient survived one year but both rectovaginal and vesicovaginal fistulas developed. This was the only case in which fistula formation was observed. Local excision of the vaginal lesion had been performed elsewhere in the second case. Recurrence of the tumor resulted in one month and radon seeds were implanted. When the patient was seen at the Clinic three months later there was massive recurrence and palliative roentgen therapy was given. The patient died six months later. The third patient underwent a vaginal hysterectomy at the Clinic in March, 1933. No cancer was observed on microscopic examination of the tissue removed. In November, 1934, biopsy was performed on a nodule in the vagina after a vaginal hemorrhage. The tissue proved to be grade 4 squamous-cell epithelioma. The lesion was treated with radium and roentgen therapy. The patient died three years, eight months after treatment. In the fourth case eighteen months after radium and roentgen therapy panhysterectomy was performed for fibroids and no evidence of malignancy was found in the organs removed, which included a wide vaginal cuff. Incidentally, this same patient underwent radical mastectomy for grade 4 adenocarcinoma of the breast in 1942, eight years after the treatment of the vaginal malignant lesion. She died ten years, five months after the treatment of the vaginal lesion. In the fifth sixth and seventh cases local excision was followed by a full course of radium and roentgen therapy. Two of the patients are living at one and a half, and three and a half, years after treatment. The third patient died four years, eleven months after treatment. This patient was apparently well for three years but after that, involvement of the vesical neck required multiple resections followed by transplantation of the ureters to the skin. Finally, death ensued from multiple metastatic growths.

Table V

Survival of patients having primary squamous-cell epithelioma of the vagina which was treated in 1930–1943

Grade of Lesion	Patients	Patients Who Lived Three Years or More	Patients Who Lived Five Years or More
2	5	3	2
3	9	2	1
4	18	10	7
Total	32	15	10

Table VI

Survival of patients having primary squamous-cell epithelioma of the vagina which was treated in 1944–1948

Grade of Lesion	Patients	Living at Stated Period after Treatment	Dead
2	1	2 years, 7 months	0
3	6	3 years, 7 months 3 years, 6 months 1 year, 6 months 1 year, 4 months 1 year, 3 months	1
4	3	0	3
Total	10	6	4

Results of Treatment. The results of treatment in 42 cases of primary squamous-cell epithelioma are shown in Tables v and vi.

Of the 10 patients who survived five years or more, 3 have subsequently died. All 3 are in the grade 4 group. One died, twelve years after the original treatment, of recurrence with extension into the rectum. The second died ten years, five months after treatment of the vaginal lesion. Six years after the vaginal malignant lesion an adenocarcinoma, grade 4, of the left breast developed. This recurred after operation and the patient died four years after the mastectomy, apparently from the lesion of the breast. The third patient died

nine years, nine months after treatment; the cause of death was unknown.

However, besides the 10 patients who survived five years or more there are 6 more patients still alive who have been treated within the last five year period. The time of survival of these 6 patients is and 7 as "early." This is admittedly a very rough division. The "early" lesions have been arbitrarily chosen as those which were less than 3.0 cm. in diameter. The others include the larger local lesions. The five year survival did not seem to have any relation to this division.

TABLE VII

PRIMARY ADENOCARCINOMA OF THE VAGINA

Case	Age, years	Complaint	Location of Lesion	Grade	Treatment	Result
1	57	Vaginal discharge	Posterior and lateral vagina	1	Radium	Dead, 6 months
2	29	Metrorrhagia	Anterior and lateral vagina	1	Radium	Living, 6 years, 4 months
3	73	Vaginal discharge	Middle third of vagina	1	Radium; roentgen	Dead, 2 years, 4 months
4	48	Vaginal bleeding	Lateral wall in polyp	4	Surgical; radium; roentgen	Dead, 2 years, 11 months

TABLE VIII

MISCELLANEOUS MALIGNANT LESIONS OF THE VAGINA

Type of Lesion	Age, years	Complaint	Location of Lesion	Grade	Treatment	Result
Hemangio-endothelioma	64	Vaginal bleeding	Anterior vaginal wall	1	Radium; roentgen	Dead, 1 year, 8 months
Lymphosarcoma	65	Vaginal bleeding	Lateral vaginal wall	*	Radium; roentgen	Dead, 5½ months
Melano-epithelioma	42	Metrorrhagia	Posterior vagina	*	Surgical; radium; roentgen	Dead, 1 year, 7 months
Leiomyosarcoma	36	Vaginal bleeding	Posterior vagina	2	Radium; surgical; roentgen	Dead, 2 years, 5 months

* Not graded.

one year, three months; one year, four months; one year, six months; two years, seven months; three years, six months and three years, seven months. Of these, 5 patients have grade 3 lesions and 1 has a grade 2 lesion.

In 11 of the 42 cases there were such extensive lesions or obvious metastatic involvement that the statement was made, before treatment was started, that the situation was hopeless and palliation was all that could be expected. Of the remaining 31 cases 24 may be classified as extensive

OTHER MALIGNANT LESIONS

The remaining 8 cases (Tables VII and VIII) are considered separately since there is considerable dispute among pathologists whether lesions other than squamous-cell epithelioma may be considered true primary lesions of the vagina. In 4 of these cases the lesions are adenocarcinomas, which are apparently primary growths of the vagina. According to Broders, adenocarcinoma may develop from the basal layer of the pavement epithelium but the usual explanation is that the adenocarci-

noma arises from remnants of Gartner's ducts or from an adenomyoma of the rectovaginal septum. In 3 of these cases the lesions were adenocarcinoma, grade 1. One of these cases was previously reported by Piper.[9] In the fourth case the lesion was adenocarcinoma, grade 4, in a polyp.

SUMMARY AND CONCLUSIONS

A total of 50 cases of primary vaginal malignant lesions have been observed at the Mayo Clinic from 1930 through 1948. The total survivals are shown in Tables v, vi, vii and viii. In all cases, the primary treatment was with radium or roentgen therapy or both. Some incidental surgical procedures were performed but these did not aim at the eradication of the lesion by surgical means alone.

There has been a gradual improvement of the survival rate of patients with primary malignant lesions of the vagina seen at the Mayo Clinic. This has coincided with the improvement in radium therapy technique and with an increased experience with this type of lesion. However, there is no doubt that this is a highly malignant lesion and one most difficult to treat. Perhaps the most important fact is that many of these patients with far-advanced lesions received very adequate palliation from radium and roentgen treatment. Thus they could live without too much discomfort, although cure was impossible. The value of a periodic pelvic examination for women in and past the menopausal age group must be stressed. The early recognition of these lesions would undoubtedly lead to a much higher salvage. Finally, even innocent-appearing vaginal lesions should be subjected to microscopic examination to avoid missing the apparently benign, but truly malignant, lesion primary in the vagina.

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DISCUSSION

Dr. Clayton T. Beecham, Philadelphia, Pa. I think Dr. Fricke and his associates are to be complimented on bringing together 50 cases from one clinic of a very rare malignant condition. This paper becomes a valuable source of help to the average gynecologist and radiologist since no one in a lifetime will see many of these cases. The therapeutic plan as outlined by the authors seems to be adequate. Unfortunately, the five year salvage has remained low. I trust that we are not adding a disturbing note when we suggest that surgery might receive some attention in this malignant disease. With modern methods and technique, a block dissection of the complete vagina, uterus, the appendages and the lymph node bearing areas is possible in a manner that has not been previously feasible. My reason for suggesting this is to be ever mindful of the therapeutic possibilities and not fall into a deep rut of routine.

Dr. A. N. Arneson, St. Louis, Mo. Dr. Fricke and his co-authors have presented a rather complete review of the subject in ques-

tion. They have emphasized the difficulties involved in classification and identification. In cases presenting cervical or vestibular involvement it may be impossible to determine the point of origin. The relative scarcity of primary vaginal cancer limits individual experience. As a result, there has not been attained the standardization of treatment procedures applied in other types of pelvic cancer.

The authors have analyzed their rather abundant material and compared their experience with results reported by others. The five year survival of 10 patients in the group of 30 with primary squamous-cell epithelioma is a marked improvement in clinical results reported previously. Definitive treatment has been by irradiation, incidental surgical procedures having been employed in only 7 of the authors' patients. No fixed plan of irradiation has been followed. The application of radium has been made by use of tubes, in plaques, or by interstitial sources, the method of choice depending upon conditions that were present. Several different methods have at times been emphasized in the same patient. Roentgen irradiation has been used alone in attempts at palliation, and also in conjunction with applications of radium. For the combined procedure the authors have generally applied roentgen radiation after the use of radium.

We have followed a similar plan of treatment except in the sequence relationship of roentgen rays and radium. Primary epidermoid carcinomas of the vagina have been considered as having a natural history simulating that of cervical tumors. Treatment is begun, therefore, with roentgen radiation applied externally, and whenever practical, by the transvaginal route. Following the course of roentgen therapy, treatment by multiple applications of radium is begun. Plaques are prepared from sponge rubber into which tubes of radium are arranged in a practical form. With regression of tumor the plaque area is made smaller, but in many instances the intensity of irradiation has been increased. Lesions on the lateral vaginal walls are treated finally by interstitial sources, and, as was noted by the authors, the treatment of lesions in the vaginal fornices includes the use of intracervical radium.

The clinical results reported from the Barnard Free Skin and Cancer Hospital, St. Louis, in 1938 have been given by the authors. In the Gynecological Tumor Clinic of the Washington University there have been between 1935 and 1948 six proved cases of primary vaginal cancer. Of that number all have died except 2, both of whom have survived the five year period. Those results are not statistically significant, but if included with the private patients seen during the same period show an average five year survival of about one-third of the entire group.

It is evident that improvement in irradiation technique has resulted in better clinical results in the treatment of vaginal cancer. The authors are to be congratulated upon reporting their results upon these relatively uncommon lesions. With accumulation of data it will be possible to establish a rationale of treatment such as has been done for cervical and endometrial cancer.

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THE PLANNING OF EXTERNAL IRRADIATION IN PELVIC CANCER*

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IN VIEW of the revival of the surgical treatment of cancer of the cervix in early cases, it is timely to note that surgical techniques are not the only ones that have progressed during the past ten or fifteen years. If competitive methods of treatment stimulate further advancement, one should not leave unchallenged the current impression that radiotherapy has attained its final refinements or its peak of efficiency.

Improvements in radiotherapy can be achieved only by increased knowledge of radiobiology and physics of radiation. By the first, one learns more of the reactions of tumors and healthy tissues to irradiation, and the factors that influence these reactions. By the second, one learns the means of delivering safely higher amounts of radiation to selected volumes inside of the body.

Much study has been made of the distribution of ionizing energy within the pelvis. In 1935, Arneson and Quimby[1] published a fundamental paper on the distribution of irradiation resulting from techniques which are still commonly used in the United States. Since that time, considerable advance has been made in the understanding of absorption of radiation by matter, in the design of ionizing chambers, and measurements or calculations of isodose curves. Special instruments, such as contour projectors and dose finders, have been developed which make possible the reconstruction of three-dimensional distribution of ionizing energy.[14,19] Mechanisms have also been designed by which small beams can be directed with greater accuracy on any given point within the body. This allows one to irradiate more homogeneously selected volumes of tissues, and reduces to a minimum the points of overdosage responsible for complications.

In radium therapy, considerable work[5,8,15] has been done on the exact dose received by all the points in the pelvis, with special attention to vital structures and regions to which the disease is likely to spread. In this way, more exact knowledge of the relative tolerance of the vital structures of the pelvis (rectal mucosa, bladder, vaginal vault, points of crossing of the ureters with the uterine arteries, etc.) was obtained.

Comparison of various known radium techniques was made and various combinations of radium sources studied. Important conclusions pertaining to the optimal type of radium applicators and radium distribution[8] have been reached; also, methods have been devised to provide routine procedures for calculating the volume distribution in all cases.[5,12]

The total number of milligram hours[11,15] varies if one uses applicators that take full advantage of the size of the uterus and vagina. For instance, if one uses the Manchester ovoids, the total number of milligram hours varies from 7,600 mg. hr. for the small ovoids and short intrauterine tandem, to 14,000 mg. hr. for the large ovoids and the long intrauterine tandem. This radium technique cannot be used safely with external irradiation unless the external irradiation is accurately planned to supplement the radium.

NECESSITY OF PLANNING

The resulting distribution of the ionizing energy is complicated; exact knowledge of this distribution is necessary in order to determine the optimal arrangement of the sources of radiation so that a lethal dose

* Presented at the Thirty-first Annual Meeting, American Radium Society, Atlantic City, N. J., June 5–7, 1949.

can be delivered to areas to which the disease has spread, and at the same time to keep points of overdosage to a minimum, particularly if such points are at the site of vital structures. Further, one must know the various dosages in the areas of extension of the disease in order to correlate them with the results obtained, and so determine the limitations of radiotherapy.

Squamous cell carcinoma of the cervix or adenocarcinoma of the body of the uterus belongs to the moderately radiosensitive group of tumors and the curative dose is high. The failure to sterilize a tumor of this group is sometimes due to an unusually high radioresistance. However, in the vast majority of the cases, it is due to the fact that the tumor has spread beyond points where an adequate dose has been delivered. A great deal has also been written on the radiocurability of metastatic pelvic nodes. Obviously, one cannot give an answer to the problem unless one knows the tumor dose delivered to the node area.

The planning of radiotherapy is based on two fundamental concepts:

1. The tumor control dose.
2. The tolerance of the healthy tissues to radiation.

Tumor Control Dose. There is no absolutely defined tumor control dose either for roentgen rays or gamma rays; the matter is further complicated by the fact that the biological action of gamma rays and medium deep therapy roentgen rays is not identical. The biological action of radiation is also a function of the fractionation. Clinical experience has shown that 6,000 to 8,000 gamma roentgens (r_γ) in less than two weeks is a tumor control dose for a high percentage of squamous cell carcinomas and that 6,000 r, delivered in five to six weeks, is also adequate. Radiosensitive adenocarcinomas respond to a comparable dosage. In any radiotherapeutic plan, the importance of the time-factor has to be kept in mind, and time-factor corrections should be used for shorter or longer periods of treatment. These time-factor coefficients are still empirical, but Strandqvist's chart can be used as a working hypothesis.

The tumor control dose has to be delivered to the whole tumor, and therefore it is not adequate to calculate it at one point. Areas are included within curves of higher dosage, giving the maximum tumor dose; the whole tumor is included within curves of lower dosage, giving the minimum tumor dose (Fig. 14).

Tolerance to Radiation. The amount of radiation that can be delivered to a tumor-bearing area is determined by the following:

1. The systemic tolerance of the body is limited by the total amount of ionizing energy absorbed. The concept of "integral dose" developed by Mayneord[6] allows a quantitative evaluation, and can be used as a criterion in the comparison of different techniques. For instance, if the tumor dose is the same for two different techniques, the technique having the smaller integral dose should be preferred. In this manner the total dose and, consequently, the tumor dose, can be increased. The formula[6] is—integral dose in gram-roentgen = K × surface dose in r (100-exit dose) where K is function of the half-value layer, focus-skin distance and area of the field.*

2. The severity of skin reactions due to roentgen irradiation depends upon the size of the area irradiated; skin reactions are at a minimum when the adjacent normal tissues can exert their maximum protective role. The maximum dose permissible is far greater for narrow strip fields. Even severe chronic skin changes are not as likely to be followed by skin necrosis on a 10 by 6 cm. field as would be found on a 15 by 10 cm. field.

Taking as the criterion of the limit of safe tolerance a moist desquamation which heals within three to four weeks after completion of treatment, Jolles and Mitchell[4] have presented a table of skin dosages for increasing areas and length of treatment. If 200 r (air dose) daily can be safely de-

* The K factors are taken from the table used at the Royal Cancer Hospital (Free) of London.

livered to two 15 by 10 cm. portals, 300 r to 400 r can be given to two smaller fields such as 12 by 6 cm. or 12 by 4 cm. The depth dose is slightly less for small fields but this is compensated for many times by the total dose which can be given.

3. The tolerance of vital inner structures, such as intestines, bladder, arteries and vaginal mucosa is a limiting factor of even greater importance than the skin, and major complications will be at a minimum if small volumes are irradiated.

The purpose of this article is to show arrangements of fields in accordance with the volume of tissue to be treated. These fields can be varied depending on whether a homogeneous irradiation to the entire pelvis is desired, or whether the parametria alone are the targets for treatment. In certain instances, a heavier dosage on the midline is preferred, and the fields will be arranged accordingly. The fields are planned so as to take full advantage of compression.

CRITICISM OF THE CLASSICAL TECHNIQUES

It has been, and still is, common practice to use four (or six) portals 15 by 10 cm., two anterior, two posterior (and two lateral) on all types of pelvic cancers. The anterior and posterior fields are usually separated by 2 cm. respectively.

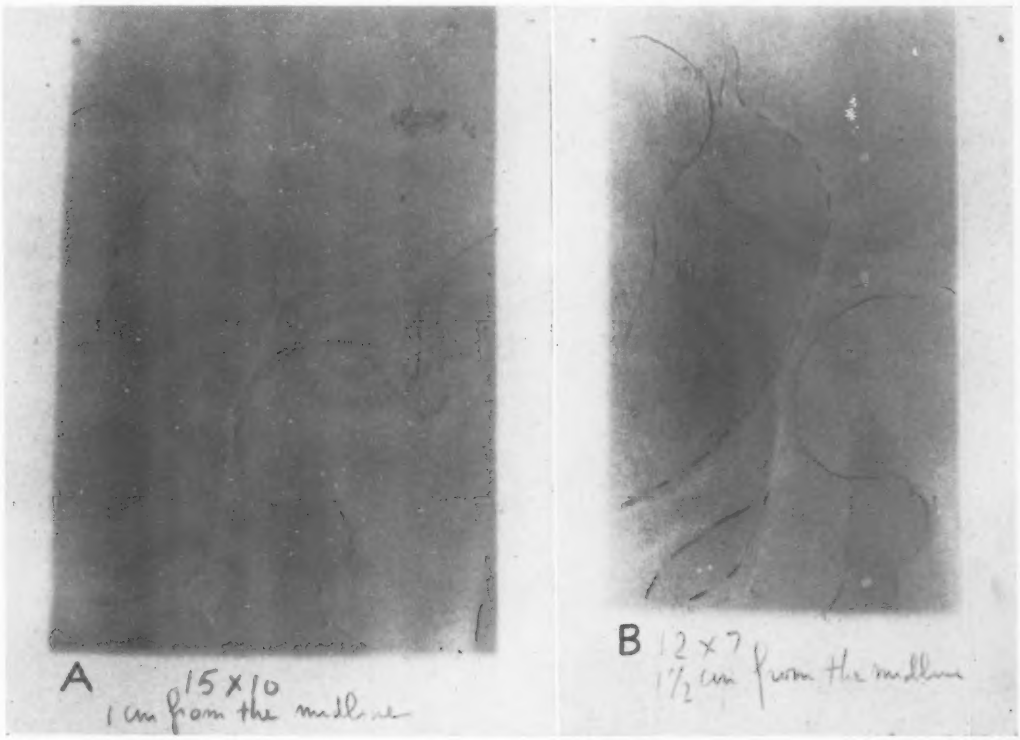

Fig. 1. Roentgenograms taken with the treatment machine. (*A*) 15 by 10 cm. portal, 1 cm. from the midline. (*B*) Same patient with 12 by 7 cm. portal, 1.5 cm. from the midline. The 15 by 10 cm. covers, unnecessarily, tissues in the iliac fossa and above the promontory. The 12 by 7 cm. covers enough of the iliac fossa and above the promontory to insure a safe margin.

The average width of the bony pelvis at the level of the attachment of the parametria to the pelvic wall is about 12 cm. Two fields 10 cm. wide and 2 cm. apart cover an area of about 25 to 26 cm. in width at the level of the parametria for a focus-skin distance from 50 to 70 cm. The periphery of the beams is in the lateral aspect of the iliac fossae. Using a field 15 cm. in length, the beam reaches higher than

the promontory and, although occasionally the pre-aortic nodes are involved, it is useless to include them in the field of irradiation, because one cannot deliver a dose to

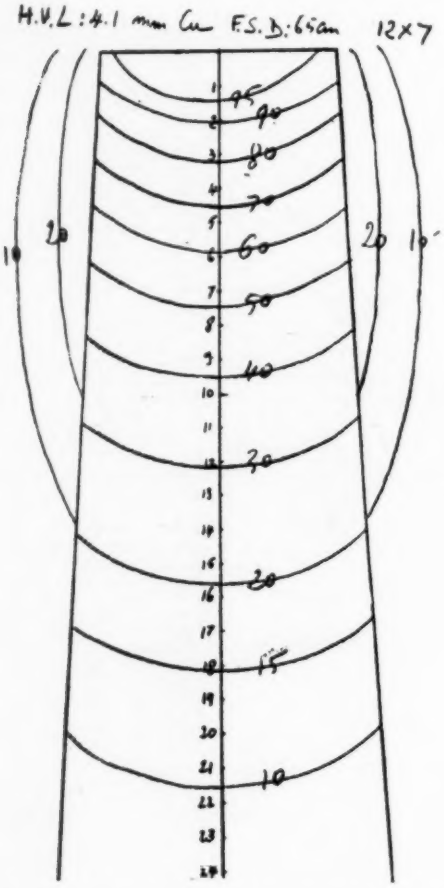

Fig. 2. The dosage rate falls slowly from the central axis towards the periphery of the beam. There is a sharp gradient in the isodose curves at the geometrical edge of the beam and a small amount of radiation outside of it.

that area which would even approach a tumor control level.

The lateral edge of applicators of 15 by 10 cm. size rests anteriorly on the anterior superior iliac spine so that compression cannot be applied. Posteriorly, the upper halves of straight posterior portals, 1 cm. from the midline, are at the level of the upper aspect of the sacrum where there is not enough soft tissue between the skin and the sacrum to allow any worth-while compression.

Portals 12 by 8 cm., 2 cm. apart, or portals 12 by 7 cm., 3 cm. apart, adequately cover the true pelvis. The 12 by 8 cm. portals will cover at the level of the parametria an area of about 20 to 21 cm. in width, and the 12 by 7 cm. portals will cover 19 to 20 cm. This includes in the field of irradiation, on each side, a margin 3 cm. beyond the bony pelvic wall and 4 cm. beyond the muscular portion of the pelvic wall. This is adequate to insure that the area to be treated is well within the edges of the beam. Figure 1 shows the comparative areas covered by anterior portals 15 by 10 cm., 1 cm. from the midline and 12 by 7 cm., 1.5 cm. from the midline; the films were exposed with the treatment machine, under treatment conditions.

Isodose curves measured or calculated with recent methods (Fig. 2) show that the decrease of the depth dose away from the central axis is not as sharp as was thought in the past. Hence, it is not necessary to use large fields in order that the tumor be relatively close to the central axis of the beam.

A 15 by 10 cm. field has an area of 150 sq. cm. against 84 sq. cm. for 12 by 7 cm. The integral dose is about half (Fig. 6) and the amount of radiation which can be given is consequently greater. Depending upon the anteroposterior diameter of the patient, a safe dose for four 15 by 10 cm. portals is between 2,000 to 2,500 r (2,500–3,100 r skin dose), at the rate of 200 r daily to two portals. Four thousand roentgens (4,600 r air dose) can be given just as safely to four 12 by 7 cm. portals at the rate of 250 r or even 300 r, if the anteroposterior diameter is at least 19 cm. These dosages are referred to a beam of a half-value layer of 4.2 mm. of copper. A moist desquamation with these small fields will heal in three to four weeks, and the danger of major late skin sequelae is negligible.[4,11]

The total dosage which can be given compensates many times for the fact that the depth dose is somewhat smaller. For instance, for a half-value layer, 4.2 mm. Cu, 65 cm. focus-skin distance the per-

centage depth dose at 10 cm. depth is 43 per cent of the skin dose for 15 by 10 cm. against 38 per cent for 12 by 7 cm. If 2,500 r (skin dose) is given to a 15 by 10 cm. portal the depth dose is then 1,075 r against 1,750 r for 4,600 r (skin dose) to a 12 by 7 cm. portal.

The addition of 15 by 10 cm. lateral portals does not add therapeutically in proportion to the extra total energy absorption. There is also an extra bone absorption, because the lateral beams go through a considerable thickness of bone. These six pelvic (Fig. 9) portals give a rather homogeneous irradiation inside of the pelvis, but the integral dose is high, between 25–30 megagram roentgens for 2,000 r (skin dose).* When this homogeneous irradiation is desirable, it can be achieved by a 12 by 7 cm. arrangement with a smaller integral dose. When external roentgen irradiation is combined with radium or intravaginal therapy, it is undesirable to have as much radiation delivered to the midline as is delivered to the lateral aspect of the parametria.

COMPRESSION

A survey of the literature shows that compression is not commonly used and that, when it is, the arrangement of fields is not devised in such a manner as to obtain maximum compression. Without compression, one cannot get a worth-while depth dose in women even moderately fat. This can be demonstrated through measurements with ionization chambers in the vagina or by calculations based on isodose curves.

A cross-section of the pelvis at the level of the middle of the portals shows that the maximum thickness of soft tissues is not straight posteriorly for the posterior portals (Fig. 3). Rather, the maximum thickness occurs obliquely; and the beam at this site goes principally through the sciatic notch,

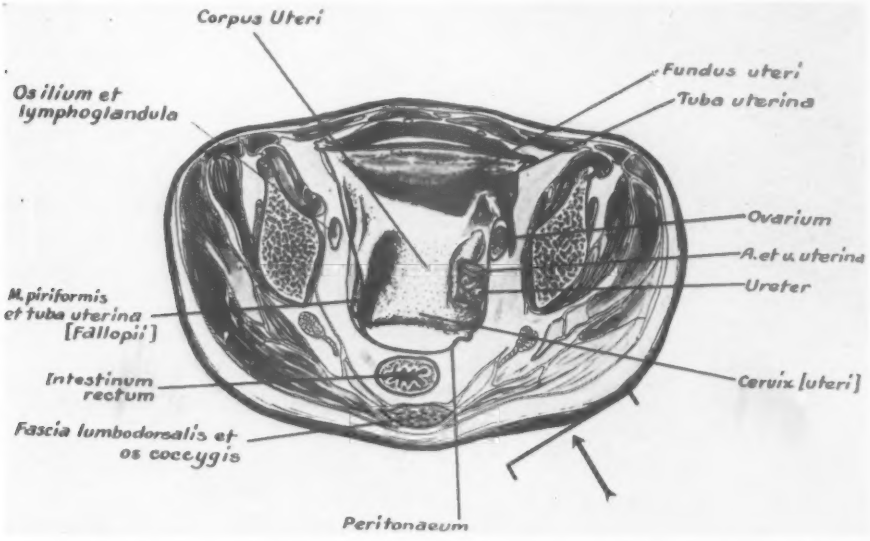

FIG. 3. Artist's drawing of Section 45 of Eycleshymer and Shoemaker "A Cross-Section of Anatomy" at the level of the fourth sacral segment. The posterior fields with their lower margin at the level of the dentate line have their center at about this level. It is seen that there is very little compression possible if one uses straight posterior fields close to the midline. The maximum thickness of soft tissue is oblique, and by compression the applicator is brought closer to the parametria and cervix. There is very little bone in the beam of rays. The drawn line shows a 7 cm. wide portal 4.5 cm. from the midline and the arrow the direction of the central axis. (Reproduced through the courtesy of Appleton-Century Co.)

* The unit used is the "megagram-roentgen," i.e., one million gram roentgens.

sparing the rectum and traversing little bone.

With applicators 7 or 8 cm. wide, one can gain, through the use of compression, depending upon the obesity of the patient, little is accomplished on the sacral fields, and none on the perineal. Figure 4 shows the compression obtained in anterior sciatic and guteal portals.

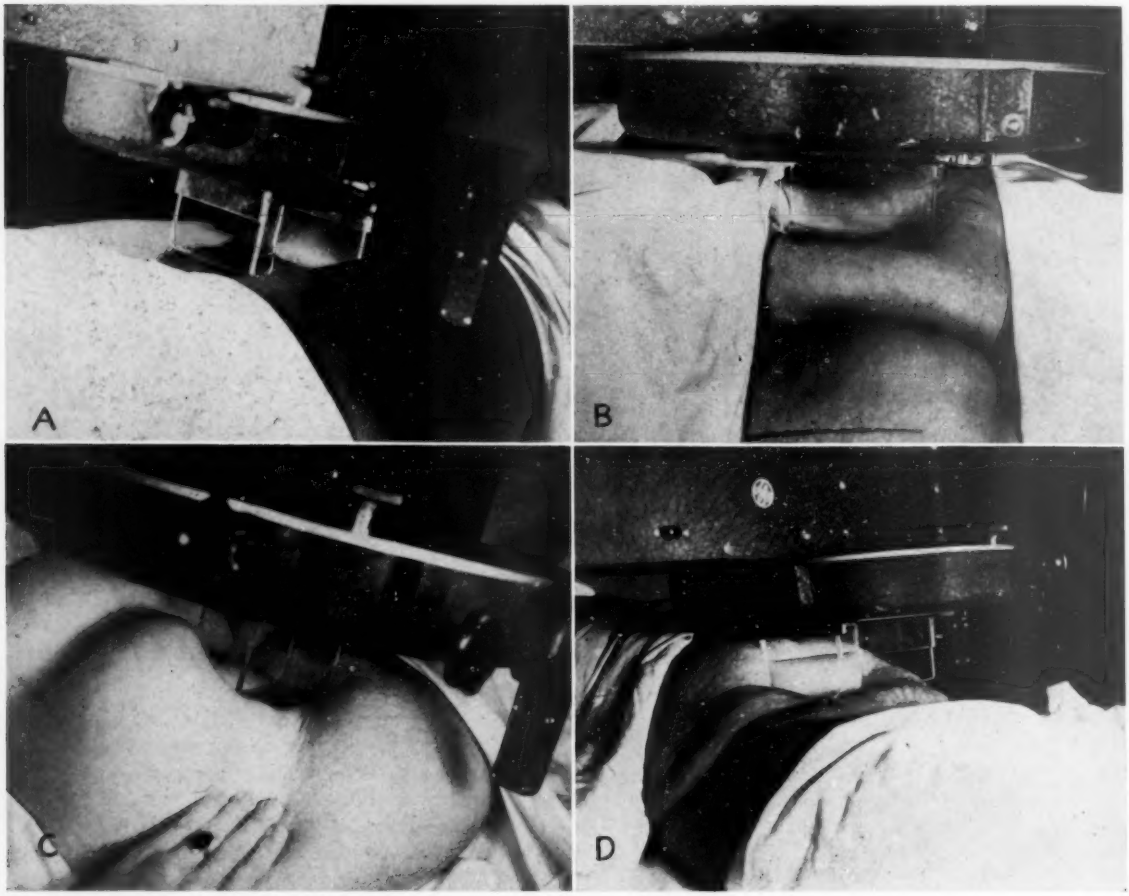

FIG. 4. Compression obtained: (*A*) 12 by 8 cm. anterior portal, 3 cm. compression. (*B*) Posterior oblique portal, 5 cm. compression. (*C*) Gluteal portal, 7 cm. compression. (*D*) Anterior portal, 12 by 14 cm. (to be used with central lead strip) 6 cm. compression. The surface of the cone is S-shaped (see Fig. 5*B*).

2 to 6 cm. on the anterior portals and 4 to 6 cm. on the posterior oblique portals. Calculations from isodose curves show, for the anterior fields, a net increase of 25 to 45 per cent over the depth dose without compression, and 35 to 55 per cent for the posterior oblique fields. Measurements with ionization chambers in the vagina have verified these calculations.

In the planning of treatment to the parametria, considerable compression is gained on anterior, sciatic, and gluteal fields, but

TECHNIQUE

In our institution, we use a 400 kv. machine, equipped with a light centering device, for the external roentgen irradiation of gynecological carcinomas. The filter used is a Thoreaus 3 mm. Cu equivalent giving a half-value layer of 4.2 mm. Cu, and the skin reactions referred to in this paper are for that particular quality of radiation. A set of plastic cones (Fig. 5), adaptable to the light centering device, has been made.

With these cones the focus-skin distance is 66 cm.

The isodose curves used have been interpolated from a set of curves supplied by E. Dale Trout of the General Electric X-Ray Corporation, and another set from the Hospital Physicists' Association of England. The depth doses on the central axis were interpolated from the survey of depth dose data by Mayneord and Lamerton.[7] The interpolations had only to be made between rather close areas so that the accuracy should be quite satisfactory. Due to the fact that the entire surface of the applicator is in contact with the skin, the isodose curves for perpendicular fields can be used.

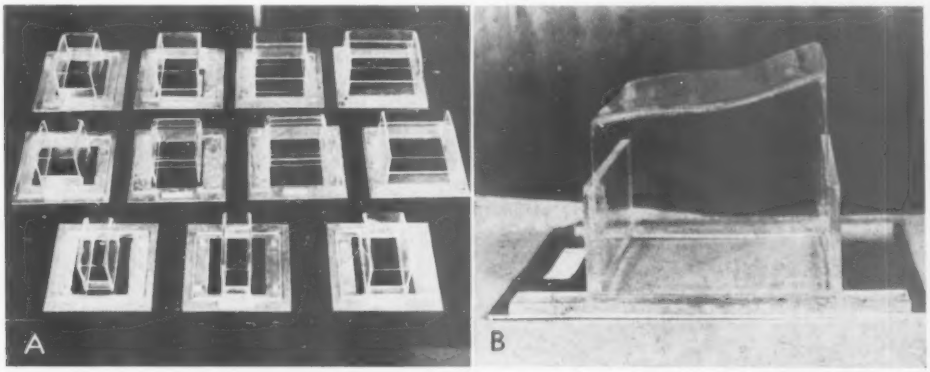

Fig. 5. (*A*) Set of plastic cones adaptable to the light centering device. The surface of the applicator is either slightly convex or S-shaped. (*B*) Cone with an S-shaped surface. The convex edge rests on the symphysis so that the other protruding edge gives 4–7 cm. compression to the abdomen. For the sacral fields the protruding edge compresses the buttocks while the convex surface fits the upper sacral curve.

Using soldering wire, a contour of the patient is taken 1 to 2 cm. above the symphysis pubis and external measurements are checked with calipers. The position of the anterior and posterior fornices is determined in both prone and supine positions. The amount of compression is measured for anterior or posterior portals, taking, in each case, the treatment table as a plane of reference. It is rechecked in relationship to bony landmarks such as the sacral ridge and the symphysis pubis. Knowing the compression, the angulation, and the distance from the midline, one can draw the portals in their exact place on the contour of the patient.

PATTERNS OF ARRANGEMENTS

The combination of fields depends upon what one wishes to achieve. External and intracavitary radiation therapy have to be closely correlated, and the arrangement may vary at different phases of the treatment in order to deliver a tumor control dose to all of the tumor bearing areas.

There are essentially two patterns of irradiation of the pelvis:

1. Irradiation to the whole pelvis.
2. Irradiation to the parametria.

One aims at irradiating the whole pelvis in ovarian tumors, in pre-radium external roentgen irradiation of cancer of the uterus, when external irradiation is the sole method of treatment, or with intravaginal therapy.

Irradiation to the Whole Pelvis. Anteriorly, 12 by 8 cm. portals if 2 cm. apart, or 12 by 7 cm. if 3 cm. apart, tilted 10 degrees to the feet, cover the tumor bearing area with a sufficient margin of safety. Compression is used to its maximum and ranges from 2 to 6 cm. The posterior portals are oblique and take full advantage of compression which varies from 3 to 6 cm. The distance from the midline and the medial tilt depends upon the contour of the patient, the compression, and the location of the posterior and anterior fornices, as the axes of the posterior portals should cross in front of the anterior fornix. The distance of the medial edge from the midline is on

the average of 4 to 5 cm. and medial tilt around 30 degrees. Figure 6*A* and *B* shows on the same patient the volume distribution with four 15 by 10 cm. portals without compression, and four 12 by 7 cm. portals with the arrangement described above. The same depth dose is delivered at the cervix and the parametria in both instances. Taking 2,000 r (skin dose) as an example, the integral dose is only 7.48 megagram roentgens for the 12 by 7 cm. arrangement against 18.3 megagram roentgens for the 15 by 10 cm.

Figure 6*C* shows a four field pattern with medial tilt of the anterior portals and it contributes a higher dosage on and about the midline. This arrangement can be useful in heavily bleeding tumors (when one wants rapid action to stop the bleeding), invasion of the anterior vaginal wall or bladder, or in cases where external irradiation is given for palliation only.

With such an arrangement 250–300 r, air dose, can be given daily to two portals, depending upon the thickness of the patient.

Irradiation to the Parametria. In cancer of the cervix the primary tumor on the cervix and the adjacent extensions in the paracervical tissues are accessible either to radium or intravaginal therapy. A tumor control dose, however, cannot be given more than 2 to 3 cm. on each side of the center of gravity of the uterine and vaginal radium sources.

Great efforts have been made to improve the tumor dose to the lateral aspect of the parametria and the lymph node bearing area by the use of interstitial needling.[3,18] According to calculations[9] there is, in Waterman's technique, no increase of the tumor dose to the pelvic wall compared with the intrauterine and vaginal applicators of the Manchester type.

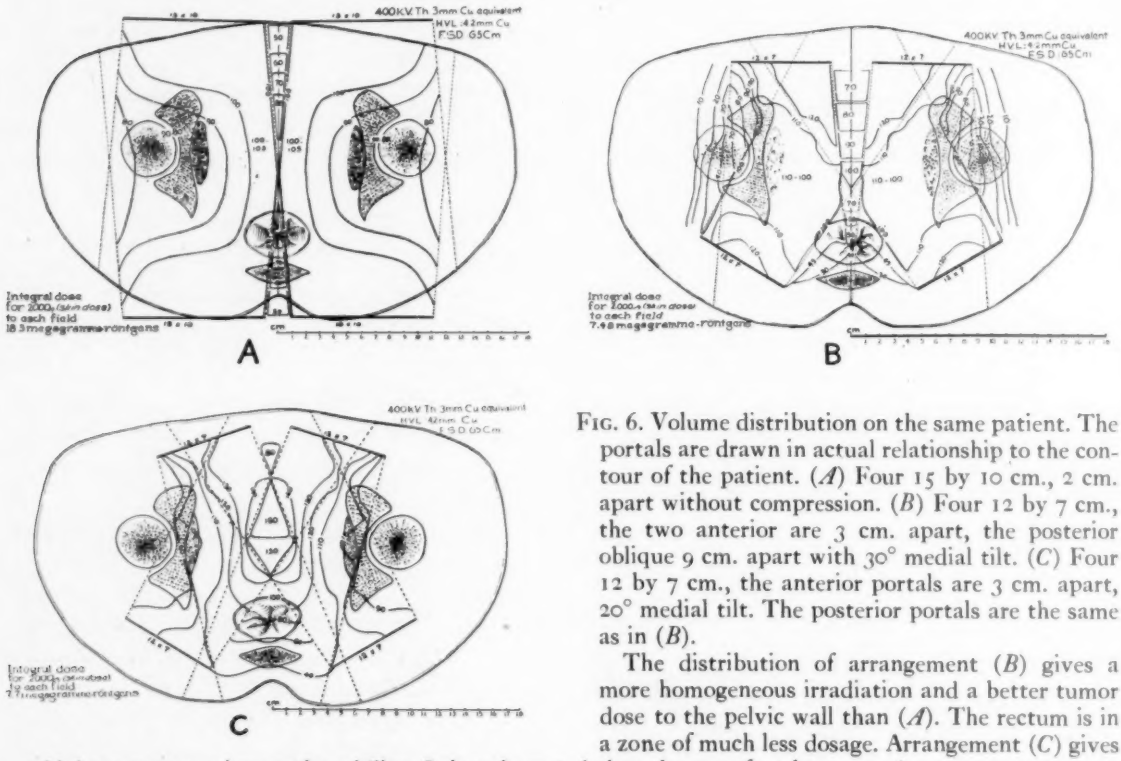

FIG. 6. Volume distribution on the same patient. The portals are drawn in actual relationship to the contour of the patient. (*A*) Four 15 by 10 cm., 2 cm. apart without compression. (*B*) Four 12 by 7 cm., the two anterior are 3 cm. apart, the posterior oblique 9 cm. apart with 30° medial tilt. (*C*) Four 12 by 7 cm., the anterior portals are 3 cm. apart, 20° medial tilt. The posterior portals are the same as in (*B*).

The distribution of arrangement (*B*) gives a more homogeneous irradiation and a better tumor dose to the pelvic wall than (*A*). The rectum is in a zone of much less dosage. Arrangement (*C*) gives a higher concentration on the midline. It is to be noted that the use of 12 by 7 cm. (7.5 megagram roentgens) instead of 15 by 10 cm. (18.3 megagram roentgens) cuts the integral dose by more than half.

Corscaden *et al.*[3] claim to deliver as much as 10,000 gamma roentgens to the pelvic wall in the "ideal distribution of radium needles." Comparison of roentgenograms with the needles in situ[3] with roentgenograms[16] of the patient with silver clips inserted at the site of the various groups of lymph nodes, at the time of lymphadenectomies, shows that the iliac and hypogastric nodes are far away from the tips of the long parametrial needles. Even the obturator nodes are barely in the neighborhood of the tips of these needles. The success of interstitial implantation depends essentially upon having a reasonably even distribution of the needles throughout the tumor bearing area so that no point will be too far away from any of the radium sources and be, then, decidedly underdosed. Experience with the tumors of the head and neck has borne out this point very forcefully. It should be common practice to use roentgenograms for control of the position of the needles and, if it is not satisfactory, one should rearrange the radium sources.

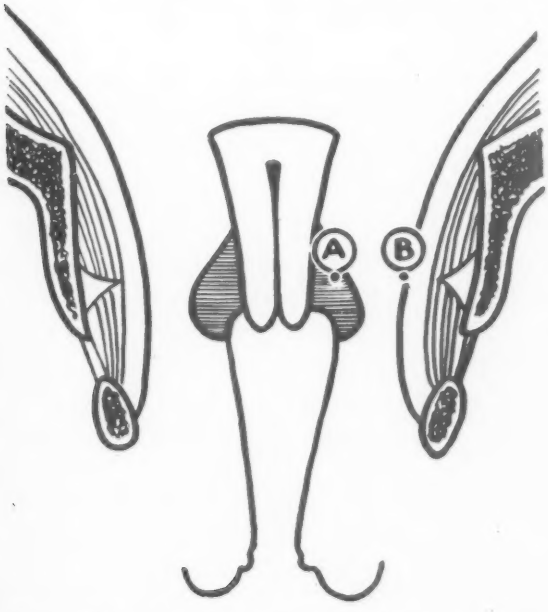

Fig. 7. Point A (2 cm. from the midline, 2 cm. from the external os) is at the crossing of ureter with the uterine artery; the ureteral node is located here. Point B (5 cm. from the midline at the same level as A) is on the muscular pelvic wall; the "principal gland" group is located here.

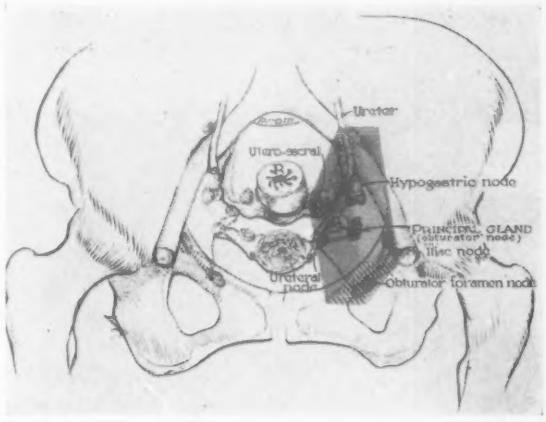

Fig. 8. Perspective drawing of the lymph nodes on the pelvic wall. Various groups of nodes from the obturator foramen nodes anteriorly to the hypogastric and uterosacral nodes posteriorly are included in the rectangular cuboid adjacent to the pelvic wall. The anteroposterior length is about 10 cm. and the depth 5 to 7 cm. The base of the cuboid is at least 50 sq. cm.

The regions to be treated by external irradiation in cancer of the cervix are the lateral aspects of the broad and uterosacral ligaments, and the four main groups of lymph nodes along the course of lymphatic spread on the pelvic wall. These nodes are the hypogastric at the bifurcation of the common iliacs, the external iliac nodes along the pelvic brim, the nodes close to the obturator foramen, the "principal gland" (or obturator node) along the lateral pelvic wall, half way between the hypogastric nodes and obturator foramen (5 to 5.5 cm. from the midline at the level of the internal os). The presacral lymph nodes, which are farther away, should also be included although it is doubtful that they can be adequately treated with any technique. Figure 7 shows the paracervical triangle as well as other points which are important in the planning of treatment. Point A is found at the intersection of the ureter and the uterine artery where the ureteral node is located. Point B is on the muscular pelvic wall 5 cm. from the midline, and here the "principal gland" is found.

In the treatment of the pelvic lymph nodes, one must keep in mind that the area

to be treated is not a small area, 5 to 6 cm. laterally, at the level of the internal os which covers the "principal gland," but rather a rectangular cuboid (Fig. 8) elongated anteroposteriorly on about 10 cm. in length and 5 to 7 cm. in height which includes the hypogastric, uterosacral, external iliac, and the "principal gland," as well as the obturator foramen lymph nodes. In correct planning, one should deliver a homogeneous irradiation to a slab of tissue from the sacroiliac joint to the obturator canal.

It is important to appreciate this three-dimensional distribution of the pelvic nodes because calculations which take into consideration only point B might not be adequate for the lymph nodes located anterior or posterior to it. It is true that this group of nodes at point B are quite commonly involved, but the whole area should be adequately treated. This is also important in evaluating the oblique fields used in certain intravaginal techniques.

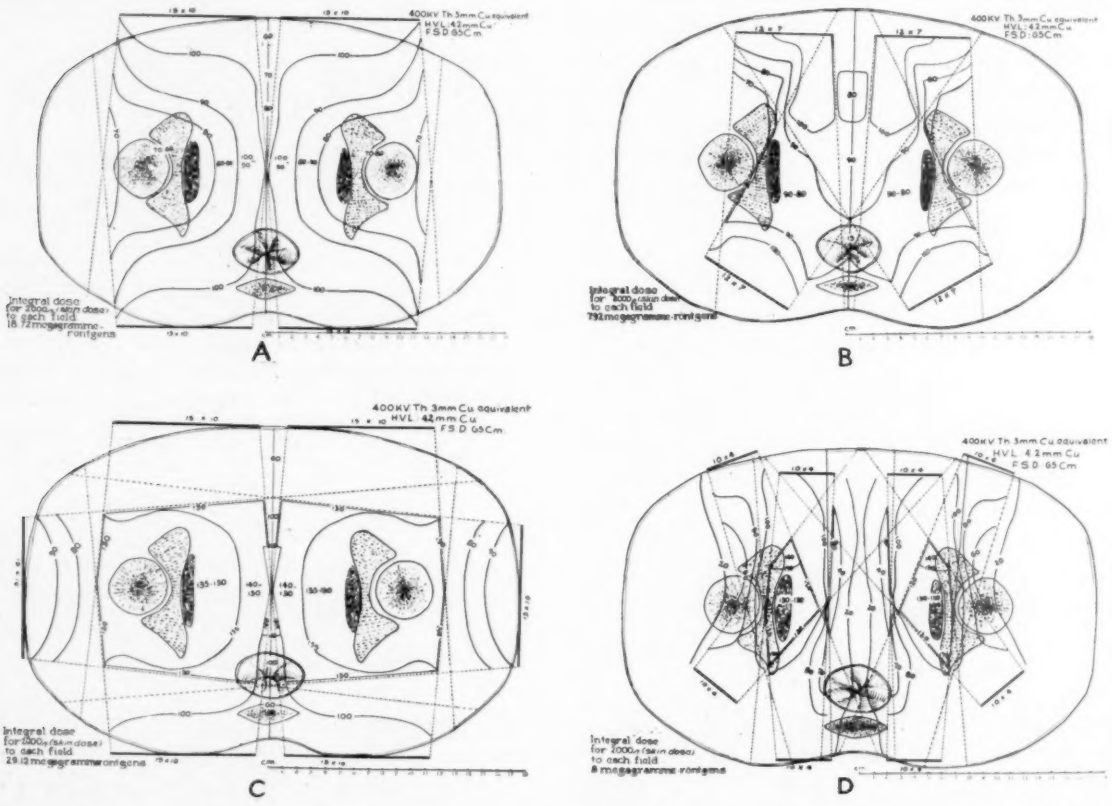

FIG. 9. Volume distributions on the same patient. The portals are drawn in actual relationship to the contour of the patient. (*A*) Four 15 by 10 cm., 2 cm. apart. (*B*) Four 12 by 7 cm. anterior portals, 3 cm. apart, posterior portals 9 cm. apart, medial tilt 30°. (*C*) Two 15 by 10 cm. portals are added to the arrangement of (*A*). (*D*) On each side of the pelvis, four 10 by 4 cm. portals are used converging on the pelvic wall. (*A*) and (*B*) give the same tumor dose with a much less integral dose in arrangement (*B*).

The arrangement with four narrow portals gives about the same dosage to the pelvic wall as the one using six large 15 by 10 cm. portals. It must be emphasized that the integral dose for 2,000 r is only 8 megagram roentgens against 29 megagram roentgens for the six 15 by 10 cm. portals.

Twombly and Chamberlin[16] estimate that with their technique of three angulated beams, giving 4,500 r to each, with 250 kv., half-value layer 2 mm. Cu, 750 to 1,500 r reaches the various groups of nodes. Nolan and Stanbro,[10] calculating the doses for various arrangements of intravaginal portals, find doses which, at 4 cm. lateral

to the midline, are only within slight tumor control, and decidedly below the tumor control level in the regions of the pelvic wall. The projection through the parametria on the pelvic wall of these angulated fields is an ellipse (15–20 sq. cm. for 4 cm. diameter cone) which covers only a fraction of the node area (at least 50 sq. cm.) even if the ideal lateral angulation is obtained to reach the pelvic wall. On this geometrical basis alone, it is evident that one cannot irradiate adequately beyond the paracervical region.

Only techniques using external roentgen irradiation can irradiate homogeneously the lateral aspect of the broad and uterosacral ligaments and the whole lymph node bearing area. There is no reason to believe that metastatic nodes from epidermoid carcinoma of the cervix are more radiosensitive than those from similar tumors of the head and neck. Then, in order to be in the range of tumor control, at least 6,000 roentgens should be given by external irradiation in six to eight weeks in addition to the 1,000 to 3,000 gamma roentgens contributed by radium.

If radium therapy is used, methods[5] are available to determine the distribution of ionizing energy around the radium sources. One can then outline roentgen radiation

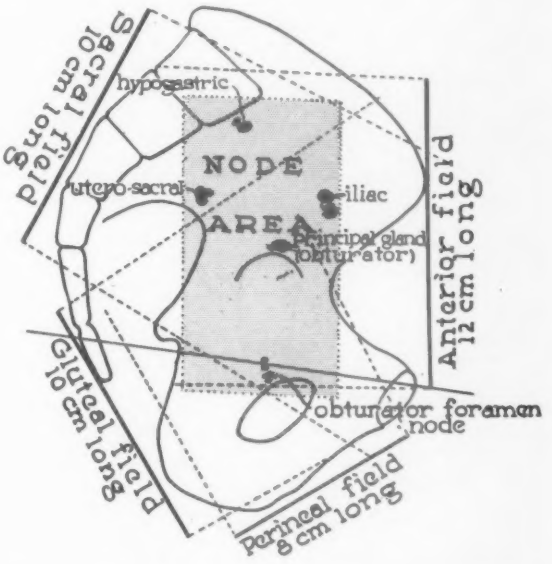

Fig. 10. Showing the node area in the sagittal plane and how the parametrial portals cross-fire it. The anterior is 12 cm. long, the sacral and gluteal 10 cm., and the perineal 7 to 8 cm.

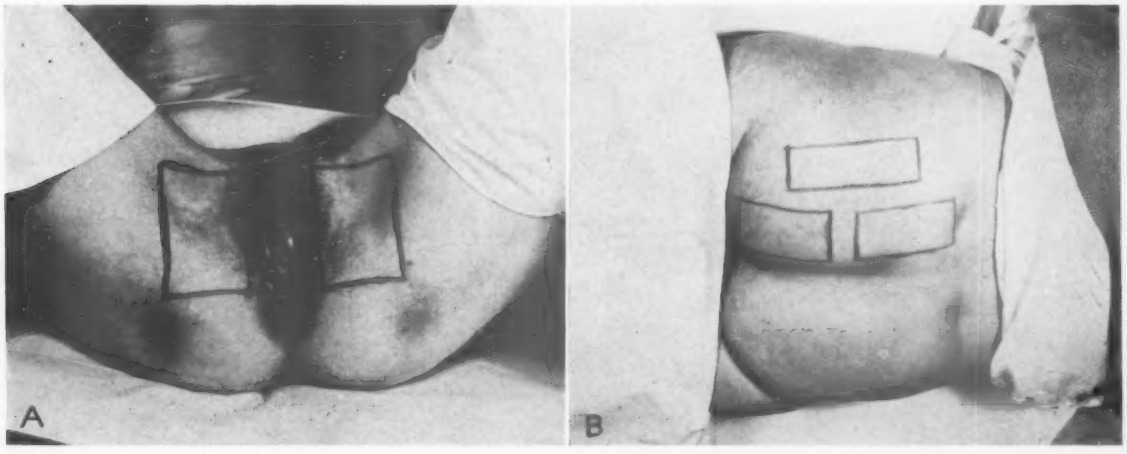

Fig. 11. (*A*) Perineal fields, or better named "obturator foramen" fields. They are 2 to 3 cm. on each side of the midline and average 7 by 4 cm. The beam is in apposition to the surface of the skin and no tilt is used as a parametrial portal. In cases where the vagina is extensively involved, these fields may be used with a medial tilt to converge on the vault of the vagina. With a light centering device the positioning is very simple.

(*B*) Sacral field: 10 by 6 cm. (5 or 4 cm.), lower margin 2.5 cm. above sacrococcygeal joint with average tilt 20° to the feet. Gluteal field: 10 by 6 cm. (5 or 4 cm.), upper margin sacrococcygeal joint 35 to 40° average tilt to the head. Sciatic field: 12 by 4 cm. to be planned according to contour of the patient, compression and width of sacral and gluteal fields. The medial margin is about 9.5 to 10 cm. from the midline and the medial tilt around 40°.

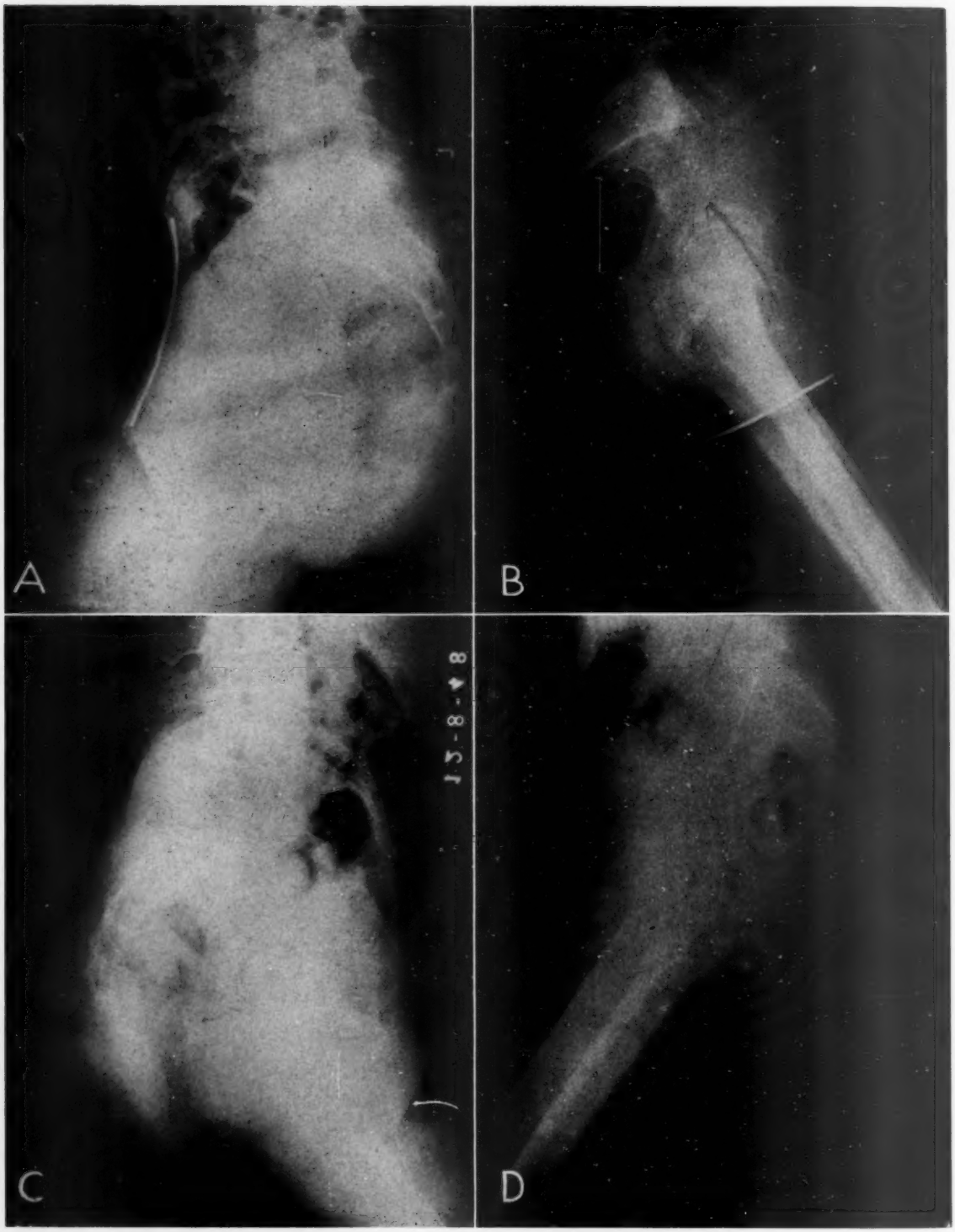

FIG. 12. Films taken with the applicators in treatment position (position, angulation, compression). A piece of soldering wire has been stuck to the long axis of the applicator. (*A*) Anterior portal. (*B*) Perineal portal. (*C*) Sacral portal. (*D*) Gluteal portal.

fields which will supplement beyond the lethal zone from the radium. The zone which has already been adequately treated, and to which any added radiant energy would only increase the danger of necrosis, would then not be over-irradiated.

Two principal patterns of arrangements can be used. In the first[11] four narrow fields, with the long axis parallel to the axis of the body, are beam directed towards point B. Figure 9 shows the volume distribution for such four 10 by 4 cm. fields directed to each parametria. The dose in the region of point B is about 130 r per 100 r (skin dose) to each field but it falls off along the long axis of the portals in the region of the obturator foramen anteriorly and the hypogastric and uterosacral lymph nodes posteriorly. The integral dose for 2,000 r (skin dose) is only 8 megagram roentgens compared to 28 megagram roentgens for six portals, each measuring 15 by 10 cm., with the same depth dose at point B.

A more homogeneous irradiation of the lymph node area can be obtained by cross-firing with anterior, perineal, gluteal, and sacral fields.[19] Figure 10 shows the geometrical relationship of these fields to the lymph node area. The anterior fields are 12 cm. long and 4 to 6 cm. wide, the gluteal and sacral 10 cm. long and 4 to 6 cm. wide, with a 20 degree tilt to the feet for the sacral, and 35 to 40 degree tilt to the head for the gluteal. The distance from the midline varies from 2 to 3.5 cm., depending upon the width of the lethal zone from the radium. The upper margin of the gluteal field is at the level of the sacrococcygeal joint and the lower margin of the sacral 2.5 cm. above (Fig. 11, 12 and 13). The perineal portals are about 7 by 4 cm., 2 to 3 cm. on each side of the vulva directed through the obturator foramen. From three to five of these parametrial fields are used on each side, depending upon the findings on pelvic and rectal examination and the thickness of the patient. In thick patients four fields are necessary to build up a lethal dose. Doses of 300 r (air dose) for portals 6 cm. in width in thin patients (16–17 cm. anteroposterior diameter) to 400 r for portals 4 to 5 cm. in width (anteroposterior diameter of at least 18 cm.) can be given daily to two portals. Bladder and rectal reactions are minimal in the great majority of cases even though 4,000 r (4,500 r skin dose) is administered. The skin reaction in such instances is at the most a partial moist desquamation which heals in a few weeks.

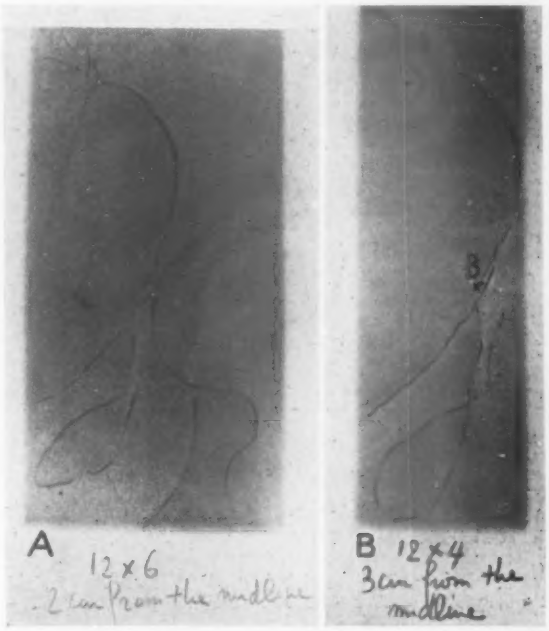

Fig. 13. Roentgenograms taken with the treatment machine. (*A*) 12 by 6 cm. applicator, 2 cm. from the midline. (*B*) 12 by 4 cm., 3 cm. from the midline.

The tumor dose in an average size patient, of 18 to 20 cm. anteroposterior diameter, varies between 130–160 r for 100 r (skin dose) to each field (Fig. 14) with an average of 150 r in the region of point B. For 4,000 r air dose in six to eight weeks (4,500 r skin dose) the maximum tumor dose is about 7,000 r and minimum tumor dose about 6,000 r. For a greater tumor dose the integral dose is about one-third (10.68 megagram roentgens) of the integral dose (29.12 megagram roentgens) of the six 15 by 10 cm. fields arrangements. This allows one to give 4,000 r (air dose) to all the fields without even taxing the systemic tolerance.

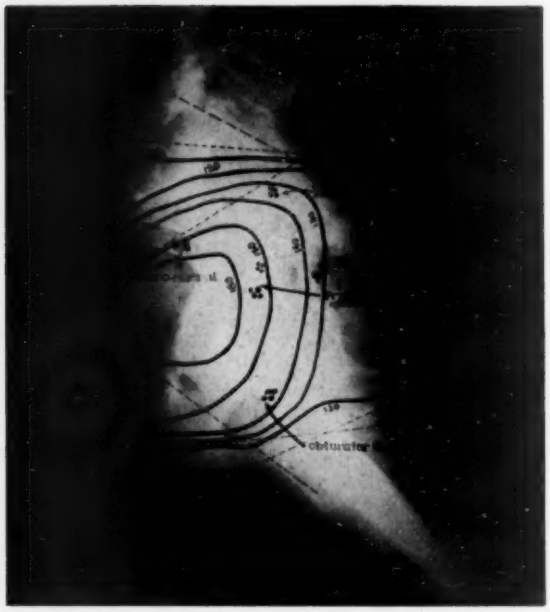

FIG. 14. Volume distribution of patient of Figure 10*B* (anteroposterior diameter 20 cm.) with an arrangement of anterior (12 by 5 cm.) sacral, gluteal and sciatic (10 by 5 cm.) fields, magnified and traced on a lateral film of the pelvis of the patient. The "principal gland" and part of the hypogastric nodes are inside the 150 curve. The whole node area is included in the 130 curve. For a skin dose of 4,500 to the four fields, the maximum tumor dose is $4,500 \times 1.5 = 6,750$ r; and the minimum tumor dose is $4,500 \times 1.3 = 5,850$ r. The integral dose for 2,000 r (skin dose) to the four fields is 10.68 megagram roentgens against 29.12 megagram roentgens for the six 15 by 10 cm. field arrangement (see Fig. 9).

Due to old inflammatory conditions or the neoplasm itself, there is often a displacement of the uterus and one fornix to one side with a resulting asymmetry of the radium volume distribution.[12,19] The parametrial portals should be planned symmetrically to the sagittal plane passing through the center of gravity, *S*, of the radium sources. The width of these portals will then be different on each side in order to cover the zone which extends from the volume adequately treated by radium to the pelvic wall (Fig. 15*B*).

In order to save time on the machine, the anterior and sacral fields can be irradiated[13] by a single cone 14 cm. wide with a lead strip from 3 to 5 cm. wide (Fig. 16), the midline of which is placed above the center of gravity, *S*, of the radium sources. An occasional drawback is that, due to the

FIG. 15. (*A*) Film of the patient with radium applicators in situ. (*B*) The dosage distribution from radium has been calculated by the method described by Lederman and Lamerton.[5] The center of gravity, *S*, of the radium sources is slightly displaced to the left and the planning is made accordingly. Fields 12 by 6 cm. on the right and 12 by 5 cm. on the left to 2 cm. from the center of gravity *S* of the radium sources are outlined. After 2,000 r, air dose, the fields are narrowed to 4 cm. wide, each 3 cm. from *S* and another 2,000 r is given. The drawing takes into account the magnification and the true size of the cross-section of the beam by the sagittal plane at the level of the broad ligaments.

larger surface of the applicator, the compression is not always as good as with a narrow applicator.

In the moderately sensitive tumors, only limited volumes can be given a tumor control dose, and it is not possible in most instances to deliver such a dose to all potential areas of spread. In concentrating where the disease is surely present, one will cure a certain number of cases.

If one side is clinically involved and the other free from disease, the involved side can be carried to a higher dose (1,000 r to 2,000 r greater tumor dose). This can be accomplished either by planning more portals on the involved side, or by carrying the portals to a higher dosage. One may give then up to 5,000 r (5,750 r skin dose) to each of the parametrial portals.

PHASES IN THE PLANNING OF EXTERNAL ROENTGEN IRRADIATION

The arrangement of fields may vary in the same case during the different phases of the treatment in order to deliver a tumor control dose to the whole tumor bearing area.

It is not within the purpose of this study to discuss the respective merits of using roentgen irradiation before radium or radium first. Examples of both will be given. If radium is used first, one determines the lethal zone from radium; this zone is surrounded by a zone where there is a sublethal dose, and farther away the dosage is entirely inadequate.

The aim is to deliver to the node area a minimal tumor dose of 5,000 r and at least 6,000 r at point B. In patients of 16–18 cm. anteroposterior diameter, this can be achieved with anterior, sacral and gluteal fields. From 19 to 22 cm., sciatic or perineal portals, or both, have to be added. Above 22 cm. only smaller tumor doses can be given, which are below what is needed to sterilize an appreciable percentage of metastatic nodes, if one goes by the experience acquired in the head and neck tumors.

In average size patients who have received 6,000 to 7,000 milligram hours of radium, portals 6 cm. wide, 2 cm. from *S* are first outlined and 2,000 r (air dose) are delivered; the minimum tumor dose is around 3,000 r. Then the portals are narrowed to 4 cm. wide, 3 cm. from *S* and another 2,000 r is given, to deliver a minimum tumor dose of 5,000 r. There is usually

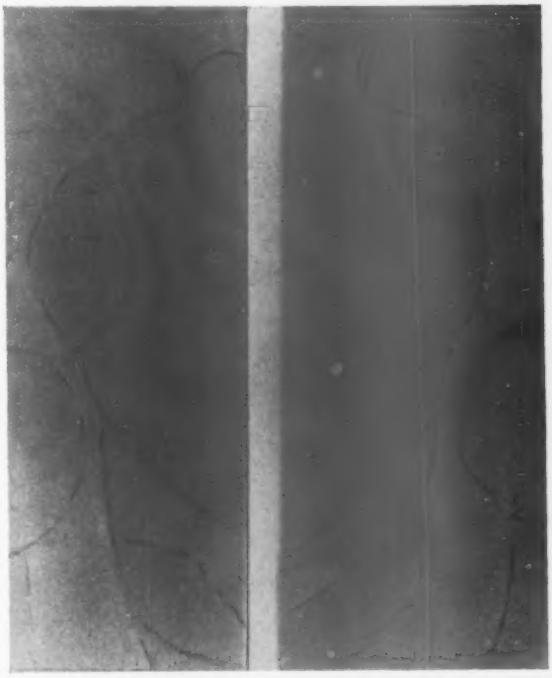

Fig. 16. An applicator 12 by 14 cm. with a central lead strip 4 cm. wide. The center of the lead strip is placed over *S*.

no systemic or rectal reaction and mild frequency. If the number of milligram hours of radium is increased, the portals may be 5 cm. wide (8,000–9,000 mg. hr.) or even 4 cm. wide (over 9,000 mg. hr.) from the beginning of the roentgen treatment (Fig. 17).

In this manner, 7,000 to 8,000 r (two weeks) will be delivered to the zone receiving a lethal dose from radium, the paralethal zone receiving from 4,000 to 7,000 gamma roentgens plus about 3,000 roentgens from roentgen rays in about four weeks. The lateral portion of the parametria and pelvic wall will receive from 1,500 to 3,000 gamma roentgens, depending upon the applicators used and the total amount of milligram hours of radium em-

ployed, plus 5,000 to 6,000 roentgens (six to eight weeks) from external roentgen irradiation. This dosage is at least twice as much as is given in the classical techniques using 200–250 kv. in which, at the most, 2,000 r is delivered to the parametria if four fields are used, and 3,000 r if six fields are used. With 800 kv., H. M. Parker[2] found, for 8,000 milligram hours and 3,500 roentgens (skin dose) to four portals, a maximum combined contribution by radium and roentgen rays of 4,500–5,000 r in the region of the "principal gland."

If one chooses to give external roentgen irradiation prior to radium, in order to decrease the size of a large cauliflower tumor or cut down infection, a tumor dose of 1,500 to 2,000 roentgens may be delivered by the arrangement of Figure 6*B*. A smaller amount of radium is given, and then after radium therapy, small narrow fields are again used to treat the parametria in order to build up the dose to a tumor control level. In this instance, the parametria have already received 1,500 to 2,000 r from the pre-radium treatment and the post-radium therapy will be given accordingly, that is to say, 5 or even 4 cm. wide fields are used from the beginning and the total dose to the pelvic wall brought to 6,000 r.

If one uses intravaginal therapy, one

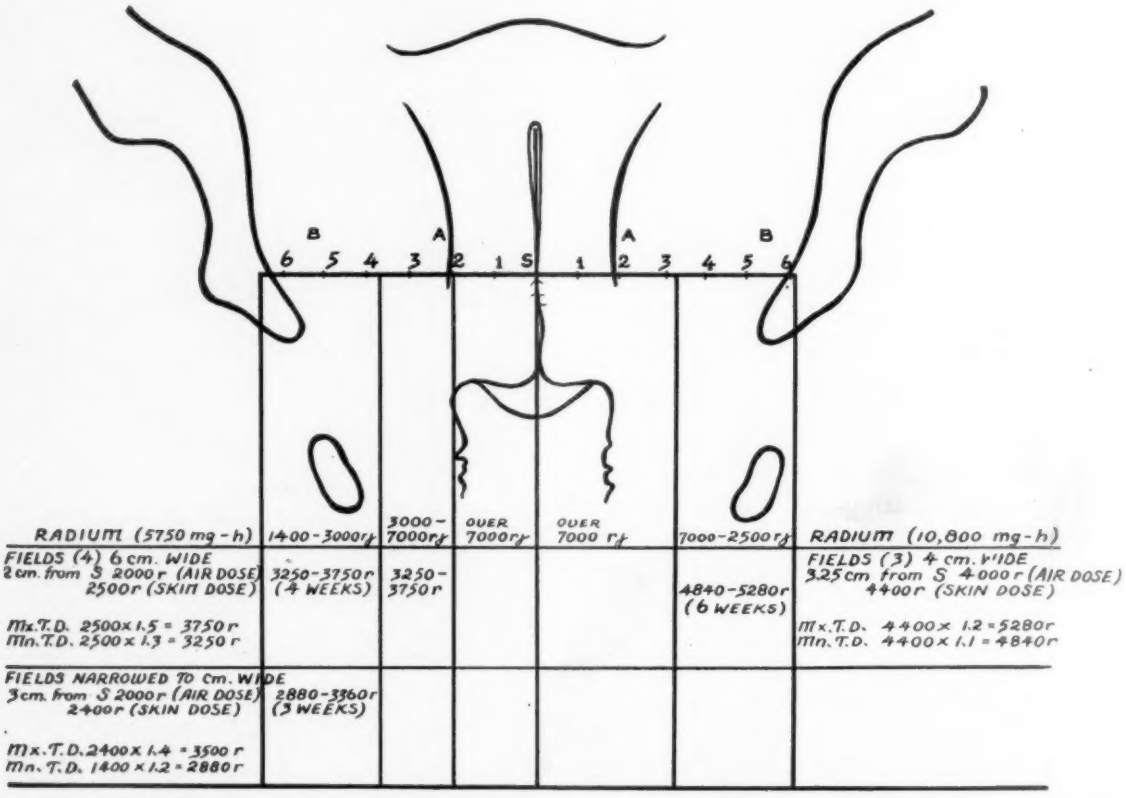

FIG. 17. Examples of planning with different amounts of milligram hours of radium. On the right 5,750 mg. hr. has been delivered, contributing 1,400 r_γ to the pelvic wall. The anteroposterior diameter of the patient is 21 cm. and four parametrial portals (anterior, sacral, gluteal and sciatic) are used. These portals are narrowed during the course of treatment. The maximum tumor dose (*Mx. T. D.*) to the pelvic wall from the roentgen radiation is 7,000 r and the minimum tumor dose (*Mn. T. D.*) is 6,100 r in seven weeks.

On the left 10,800 mg. hr. has been delivered, contributing 2,500 r_γ to the pelvic wall. The anteroposterior diameter is 18 cm. and only three parametrial portals (anterior, sacral and gluteal) are used, 4 cm. wide from the beginning. The maximum tumor dose from the roentgen radiation is 5,200 r and the minimum tumor dose is 4,840 r in six weeks.

may combine for the first weeks, arrangements of Figure 6*B* with intravaginal treatment. Then when an adequate dose has been given to the cervix and paracervical tissues, one builds up the dosage to the lateral portion of the parametria by the technique described above.

In both techniques the over-all time of treatment is eight to nine weeks. In that period of time the pelvic wall in the region of the "principal gland" will receive 1,500 to 3,000 gamma roentgens from radium and 6,000 roentgens from roentgen radiation.

Experience in the treatment of metastatic lymph nodes from squamous cell carcinomas of the head and neck shows that a considerable amount of irradiation is required to sterilize them. Some clinical observations have indicated that longer fractionations may be beneficial because, due to the tumor bed, one has to rely primarily on the direct action of radiation.

The correspondence of the percentage of failures in each stage of the disease with the percentage of microscopic lymph node involvement found in surgical specimens suggests the possibility that the control cases represent the ones without lymph node involvement. The doses given with the technique described above are higher than those given before. Lymphadenectomies and follow-up will show if they are adequate to cure metastatic nodes.

SUMMARY

1. The planning of radiotherapy in pelvic cancer is based on the delivery of a tumor control dose to the whole tumor bearing area. It is limited by the tolerance to radiation of the organism and the normal tissues. This tolerance is in direct proportion to the size of the portals and only small volumes of tissue can be given high doses.

2. The commonly used techniques of external roentgen irradiation involve the use of large fields, irradiating unnecessarily too large amounts of normal tissues. Smaller fields cover adequately the whole of the true pelvis.

3. The importance of compression in view of increasing the depth dose is demonstrated.

4. External roentgen irradiation should be correlated with the intracavitary radiation treatment of the primary tumor on the cervix. Different arrangements of fields should be used, depending upon whether or not one wishes to irradiate the whole pelvis or the parametria only.

5. During the course of treatment, rearrangements of fields are often necessary in order to bring the lymph node area along the pelvic wall to an adequate dosage.

We are indebted to Mrs. Ella Mae Shackelford, medical artist, for the editing of the volume distribution curves and the anatomical sketches; to Miss Mary Walker, R.N., supervisor of the Radiotherapy Department, for her help with the measurements and working out of the details of the technique.

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DISCUSSION

DR. CLAYTON T. BEECHAM, Philadelphia, Pa. In discussing Dr. Fletcher's paper, I am so impressed by this logical plan of irradiation that I feel incompetent to discuss it adequately. If such a systematic or as complete an approach has ever been offered before I am unaware of it. It is fortunate for the cancer patient that much thought continues to be exercised in the direction of improved therapy as that documented here this afternoon. The essayist used the words "competitive method" in briefly referring to surgery and irradiation. I wonder if we should ever regard one theraputic method as a competitor of another when we only desire to improve salvage from malignancy. Ideally, the clinician should be able to employ all proved methods in an effort toward a maximum salvage. To state that one method is the only way to treat a carcinoma, of course, is illogical thinking. Each case should receive individualized consideration and not be subjected to a set routine therapy.

As a gynecologist, I am unable to fully interpret the radiophysics as outlined by Dr. Fletcher; however, I am deeply impressed with his very complete attempt to irradiate every potential area of spread within the pelvis. His three-dimensional distribution plan seems consistent. The statement that "radium technique cannot be used safely with external irradiation unless the external irradiation is accurately planned to supplement the radium," is such a basic truth, there is no argument. The Departments of Gynecology and Radiology working together at Temple University Hospital follow such a plan where irradiation is used.

Before applying therapy there should be an accurate evaluation of the extent of the disease or assigning a clinical stage to each case when treatment is started. We have felt that where two experienced examiners appraised a given cervical carcinoma and agreed on the clinical stage the chances of error were not great. Since employing radical surgery in 43 cases, however, we have found a 58 per cent error in judging the extent of cervical carcinoma. Our experience has led us to place little reliance on the accuracy of pelvic examination as related to local spread or lymph node involvement. Therefore, in planning irradiation one should include the node bearing areas so well outlined by Dr. Fletcher. If one chooses to reach either the hypogastric or the obturator nodes, and certainly he should with radium needles, he is applying a very dangerous procedure and one that can yield little, if any, effect. From the anatomy of these two areas I cannot see how they can possibly be adequately irradiated except by oblique field as outlined by Dr. Fletcher. The operative findings to date have not shown irradiation too affective in the eradication of involved lymph nodes. We hope Dr. Fletcher's technique may prove an adequate control measure.

DR. A. N. ARNESON, St. Louis, Mo. It has not been possible for Dr. Fletcher to present within the time allotted his presentation all of the data given in his paper. Having had the opportunity to read the text and view the several illustrations, I recommend your study of the article when it appears in published form.

Dr. Fletcher's stated purpose is to show arrangements of fields in accordance with the volume of tissue to be treated. Each circumstance

is analyzed in relation to control of tumor and the tolerance of healthy tissues. He has considered systemic effects (integral dose) as well as severity of skin reactions and effects upon such structures as bowel, bladder, etc. Variations are made according to aims toward homogeneous irradiation to the entire pelvis, or toward irradiation of the parametrial regions alone.

Dr. Fletcher employed a harder quality of radiation and a greater focus-skin distance than may be used in many clinics, but the fundamental concept of his method is based upon the use of small skin fields. Full advantage is taken of the use of small cones by placing them at points that permit maximum compression of soft tissues to shorten skin-tumor distances. It is interesting to note that relative depth dose values, verified by ionization measurements made within the vagina, show increases ranging from 25 per cent to 55 per cent over those that would be obtained from the same cones resting upon fixed bony structures of the pelvis. Any loss incurred per treatment in the percentage of radiation arriving at tumor depth through reduction in size of irradiated area is more than compensated for by the increase in total dose tolerated by small areas. The total effective dose is made adequate by employing a number of different areas for irradiation. From a practical standpoint it might appear that the optimal number of small fields to be used would be limited by increase in integral dose. Dr. Fletcher presents values, however, that indicate a lesser integral dose than would be incurred from the use of four pelvic fields measuring 10 by 15 cm.

There is no doubt that the larger areas irradiate a greater volume of tissue than is necessary. For such fields we have found necessary an upper limit in total dose per area of 1,600 r (air). With reduction in amount of external irradiation the attempt has been made to compensate for loss in total tumor dose by increasing biologic effect through higher intensities of irradiation. Radium is applied during the course of roentgen treatments, and repeated immediately after completion of roentgen treatments. Various sequelae have occurred, and in one patient damage to the small bowel necessitated resection of the injured area. There is no evidence of reappearance almost three years after treatment, but normal digestive function has never been regained. Of significance, also, is the fact that no patients in Stage IV have been free of recurrence for five years. Those points are presented to substantiate Dr. Fletcher's criticism of the use of the 10 by 15 cm. skin fields. At the same time it is important to attempt irradiation of all the tumor bearing region. At one point in his paper Dr. Fletcher expresses doubt that an adequate dose can be delivered to the regions of the secondary groups of lymph nodes. That is probably correct, but we have elected, in addition to small fields over the lower pelvis, the use of a centrally located anterior portal with the inferior margin about 10 cm. above the level of the symphysis. The distribution of radiation has not been studied with the thoroughness pursued by Dr. Fletcher, but the area in question is believed of particular importance in the treatment of endometrial cancer.

The methods described by Dr. Fletcher require a high degree of precision. He has emphasized the interdependence of roentgen and radium treatment. Variations are proposed for different conditions, and even for the same patient during different phases of treatment. His presentation is well timed and points toward further advance in the treatment of pelvic cancer. It has been a pleasure to read and listen to the paper and an honor to discuss it here.

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Published by: CHARLES C THOMAS, PUBLISHER, 301–327 East Lawrence Avenue, Springfield, Illinois.

Issued monthly. Annual subscription: United States, Mexico, Cuba, Central and South America, $10.00; Canada, $11.00; other countries, $12.00. Advertising rates submitted on application. Editorial office, 110 Professional Building, Detroit 1, Michigan. Office of publication, 301–327 East Lawrence Avenue, Springfield, Illinois. Information of interest to authors and readers will be found on page iv.

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EDITORIALS

THE FIFTIETH ANNIVERSARY OF THE AMERICAN ROENTGEN RAY SOCIETY

THIS year the American Roentgen Ray Society celebrates the Fiftieth Anniversary of its organization and it is particularly appropriate that the meeting should be held in St. Louis where, in 1900, a small group of enthusiastic men gathered to organize themselves into a society which in subsequent years became known as the American Roentgen Ray Society.

The America of 1900 was a far different country in some respects than it is today.* The United States in 1900 had a population of about seventy-six million persons; whereas today our population is over one hundred and fifty million. Not only has there been a great increase in the population but there has been an unbelievable increase in the monetary wealth of the nation and a proportionate increase in the health of the nation as evidenced by the enormous number of private and public agencies which are devoting their energies and time not only to the improvement of the health of this nation but also to the improvement of the health of the nations of the world.

In 1900 William McKinley, Republican nominee, was re-elected President, defeating William Jennings Bryan who ran as a Democratic candidate on the platform of free silver. The Spanish-American War had just been ended in April, 1898, and a Treaty of Peace was signed at Paris on December 10 of that year. Spain withdrew from Cuba and relinquished Puerto Rico, Guam and the Philippine Islands. The United States took her place as a world power and consequently the American citizen of 1900, reading his daily newspaper, discovered that the headlines continued to occupy themselves with the Philippines, Cuba, Puerto Rico, Guam, Aguinaldo and the Igorrotes, "words which three years before had had no more meaning to him than to stir old memories of something he had seen only in his schoolboy geographies." Some of these names were to come back to us in the tragic days of World War II when the Philippines and Guam occupied places of paramount importance in the military reports.

The year 1900 was also a period of great activity in the formation of large industrial and business organizations. The culmination of the organization of the United States Steel Corporation took place in 1901 and the Currency Act establishing the gold standard was passed in 1900, and it may be of passing interest to note that the gold bouillon of the capitals of the world is today accumulated in a small area in the State of Kentucky. Hawaii which today is only a few hours' flight from the State of California was organized as a Territory of the United States in 1900, following the annexation of the Hawaiian Islands on August 12, 1898. China in 1900, as today, took its share of the headlines of the front pages of the newspaper. The so-called great nations of the world were embroiled in the partition of China. Germany claimed her share as did England and France and Russia, but through the intervention of our then great Secretary of State, John Hay, the nations agreed to the Open Door Policy in China, wherein the nations would recognize the sovereignty of China and her claim as an independent nation and cease encroachment upon her lands. Shortly after the formulation and the agreement to this treaty there occurred the great Boxer up-

*Sullivan, Mark. Our Times: The Turn of the Century. Charles Scribner's Sons, New York, 1926.

rising in China which required the cooperation of the then "united nations" to quell it, as the state of China itself was such as to be unable to control its internal as well as its international affairs. Heavy indemnities were levied against China. America's share of that indemnity was twenty-four million dollars. This was more than enough to meet the American claims and a few years later, during the administration of President Theodore Roosevelt, eleven million dollars of this indemnity was returned to China to be used for educational and cultural purposes, a hitherto unparalleled gesture to a conquered nation.

One of the greatest events that took place in the year 1900 was the diplomatic preparations for the construction of the Isthmian or Panama Canal. The famous Hay-Pauncefote Treaty was signed on February 5, 1900, but this treaty failed to be effective until a later date.

Around the year 1900 was the beginning of the automobile manufacture in Detroit and the great work of perfecting the automobile for public use was undertaken by Henry Ford and Charles B. King and in 1900 the first automobile for sale built in Detroit was manufactured by the Olds Motor Company.

Around the year 1900 Andrew Carnegie began his great philanthropies by giving more than five million dollars to New York City for libraries and in December, 1901, he gave ten million to found a Research Institute in Washington which is known today as the Carnegie Institute. These great gifts of Carnegie initiated an era of donations to found institutions of learning and for scientific research and scholarly investigations.

In the international realm in the year 1900 the diplomacy of the period centered around the struggle for spheres of influence in China, particularly between the British Empire and Russia, and the quarrels between the British Empire and France over African possessions out of which subsequently grew the Anglo-French Entente and the rising friction with Germany, especially over its Navy. The Boer War in South Africa which the British had hoped would come to an early conclusion was still in progress. In 1900 the Paris International Exposition was held and one of the events of great national importance was that Count von Bülow succeeded to the Chancellorship of Germany under the then great Wilhelm II and during the chancellorship of Count von Bülow the Pan-German movement and its imperialistic doctrines held sway. While Czar Nicholas II was still Czar of All the Russias, in 1900 the Trans-Siberian Railroad was completed. The completion of this railroad reflected both the industrialization of Russia and its push to the Pacific.

Around the turn of the century there was also great scientific and intellectual progress. In 1895 Röntgen announced the discovery of the X-rays. A year later, in 1896, Marconi applied for the first patent for wireless telegraphy and in 1899 Marconi startled the world by transmitting a wireless message across the English Channel and Count Zeppelin made successful tests of a dirigible balloon. In 1897 the Diesel engine was invented; in 1898 the Curies announced the discovery of radium; in 1898 William James formulated his philosophic theory—pragmatism. The intensive work on malarial infection in the years 1899–1905 resulted in the announcement that malarial infection was traced to the *Anopheles* genus of the mosquito. The great work of Walter Reed and his associates on yellow fever traced the source of this to the bite of a female *Stegomia* mosquito. Quickly upon the announcement of this startling bit of scientific discovery, Gorgas and his group of coworkers began the extermination of this disease as well as malaria both in Cuba and on the Isthmus of Panama which made possible the digging of the Panama Canal. Thus began the "conquest of the Tropics."

The epoch-making investigations and discoveries of the great Pasteur had established the microbic view of the origin of

disease and Koch having improved and elaborated the methods for detecting and examining these minute organisms laid the foundation for the establishment of modern bacteriology and in the year 1900 was founded another great society—the Society of American Bacteriologists.

There also occurred in 1900 a small gathering of a forward looking group of young doctors in St. Louis for the purpose of organizing a society whose principal purpose would be the study of the roentgen rays and their application to medicine and science. This society became known as the American Roentgen Ray Society. This gathering of enthusiastic young men did not make the headlines of the daily press of those days; neither did it impress greatly the scientific world. But the foundation of that group's meeting was a solid belief in the possibilities of the roentgen ray as a diagnostic method, and by dint of sheer determination against all sorts of adversity and frank discouragement these early workers in the field of roentgenology have elevated it from an unknown and somewhat discredited specialty to the high place it now occupies in the hospital organization and in the practice of medicine; and it may be stated without equivocation that radiology as we know it today has contributed more toward making the "healing art an exact science than any other procedure." As has recently been stated by one of America's great surgeons, "All those who are ill and all of those who treat the ill owe roentgenologists a debt of gratitude for the devotion and intelligence with which they have advanced their special branch of medical science."

Roentgenology occupies its position of importance today as a result of the prophetic vision of the early workers in this field of medicine, and to them we owe much for they blazed the trail and laid the pathway over which we late comers travel so easily. The members of the American Roentgen Ray Society may justifiably take pride in the contributions which they have made toward the advancement of medicine.

In the early days, those who engaged in the practice of roentgenology had not only to devote their time to the interpretation of their roentgenograms but also a great deal of their time was consumed in the technique and development of instruments of precision for the more complicated examinations which were constantly being demanded. We today are relieved of those wearisome details as once an idea for a new type of instrument is promulgated we have at hand capable manufacturers who are willing to expend their time, their money and energies toward the perfection of these instruments of precision, thus permitting today's roentgenologist to give his time to the clinical aspects of roentgenology.

This small group of men who met to organize the American Roentgen Ray Society within five years after Röntgen's announcement of the discovery of the X-ray were not quibbling over the medicolegal aspects of the "skiagram" as was so constantly being done in the surgical societies of that time but they had in mind the broad general applications of roentgenology and the possibility of its general diagnostic and therapeutic aid in the practice of medicine. These are the thoughts and the actions and the work that have culminated in the great organization that is the American Roentgen Ray Society as we know it today. And as has been said, the whole history of roentgenology from its incipiency to the present time is one of steady development. No single episode which has resulted from a scientific endeavor has so greatly influenced the progress of the human race as the discovery of the roentgen rays and there is no branch of medicine which has not benefited by their employment. Our annual meetings are an expression of the year to year progress of roentgenology and the contributions that it makes toward the advancement of medicine.

At first following the formation of the American Roentgen Ray Society, its annual meetings were published in the form

of *Transactions*, but in 1906 the Society had grown to such proportions that there was established a quarterly publication, the *American Quarterly of Roentgenology*. This was later expanded, in 1913, to a monthly publication and its name changed to the *American Journal of Roentgenology;* with the formation of the American Radium Society, the Journal became the official organ of the two societies and its name again changed to its present title—the *American Journal of Roentgenology and Radium Therapy*.

The important place which roentgenology holds in the medical world today places the roentgenologist in a somewhat privileged as well as a somewhat enviable position and since we as physicians have been in the vanguard of the advancement of modern physics we must take our share of responsibility in the furtherance of research methods for future investigations.

Ever since the announcement of Röntgen of his discovery of the X-rays and the Curies of their discovery of radium, there has been continuous research and investigation into possible radiant energies, and within these last years we have reached the age of atomic fission which has given rise to a new science of non-static biology which offers unlimited fields of investigation both in the normal and in the abnormal tissue structures in plants as well as in animals.

The year 1950 falls quickly upon the heels of a second World War. It has witnessed the crumbling of great empires and the encroachment by some nations on the territories of free and unprotected smaller nations, and in the distant parts of the world is heard again the roar of the planes and the boom of the cannons in spite of concerted agreements. In the midst of this, the scientific world is bending all of its efforts toward the improvement of the health of mankind over the face of the earth and among the great contributions in the accomplishment of this is the employment of the roentgen ray in all of its phases. Thus science and medicine remain the only two agencies in a distraught world that extend without question or equivocation their helping hands across the borders of all nations.

Fifty years ago at the organization meeting of the American Roentgen Ray Society the members composing that small group could not in their wildest dreams or imagination picture the roentgenology of 1950, even though they had high hopes and an earnest belief in what roentgenology had to offer in the medical world as an aid in the diagnosis and treatment of disease. On the threshold of the Fiftieth Anniversary Meeting of the Society, we, too, can only faintly visualize the roentgenology of fifty years hence. But the roentgenology of fifty years hence will be largely an exposition of the toil and effort which we of today contribute toward its advancement.

THE ANNUAL MEETING OF THE AMERICAN ROENTGEN RAY SOCIETY

THE Fifty-first Annual Meeting of the American Roentgen Ray Society will be held from September 26 to 29, 1950, at the Hotel Jefferson, St. Louis, Missouri. The scientific sessions of the meeting will be held in the Gold Room of this hotel, with the Scientific and Commercial Exhibits on the same floor. President-Elect Widmann and the members of his Program Committee have arranged a program which should be of interest to all radiologists. The program is a varied one and some idea of its scope may be had by reference to the Preliminary Program which is published elsewhere in this issue of the JOURNAL.

This year's Caldwell Lecture, on Wednesday evening, will be given by Dr. Henry L. Bockus who is Professor and Chairman of the Department of Internal Medicine in the Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania. Dr. Bockus has chosen for the topic of his lecture "The Role of Roentgenology in Gastroenterology." Dr. Bockus is one of America's outstanding gastroenterologists and the Caldwell Lecture given by him should, in itself, be of sufficient attraction to warrant a journey to St. Louis.

The Instructional Courses, which are always a worth-while feature of the annual meetings, have been arranged by Dr. Harry M. Weber, and elsewhere in this issue of the JOURNAL will be found a detailed description of the various courses that are offered at this year's annual meeting and also a list of the instructors. It is earnestly requested that those who are interested in taking these courses make application immediately on the form accompanying the description of the courses.

Dr. Widmann and his Committee have arranged as a part of their Scientific Program three symposia which should be of great interest to all radiologists; namely, one on "The Training of Residents in Radiology," another on "Protection in Radiation," and the third on "The Treatment of Carcinoma of the Cervix," in addition to a well rounded program dealing with all phases of diagnostic roentgenology as well as roentgen and radium therapy.

Dr. R. A. Arens and his committee have gathered together a very excellent group of Scientific Exhibits which will give added interest to this year's meeting and the manufacturers have made reservations for an unusually large and comprehensive Commerical Exhibit of radiological and accessory apparatus.

The Committee on Local Arrangements headed by Dr. Wendell G. Scott as Chairman, and the Ladies Committee with Mrs. Wendell G. Scott as Chairman have arranged a splendid program of entertainment. On Thursday evening will be held the Annual Banquet which is always one of the outstanding social events of the meeting. On Monday, September 25, will be held the annual Golf Tournament for members and guests. This year's tournament will be held at the Sunset Country Club and competition will be for the Willis F. Manges Trophy (eighteen hole medal handicap, for members) and the Exhibitors' Trophy (eighteen hole gross score, for members and guests). Following the Golf Tournament the annual Golf Dinner will be held at the Sunset Country Club at 7:30 P.M.

It is earnestly requested that those who anticipate attending the meeting make application at once for reservations. A form for application for reservations will be found in the advertising pages of this and several previous issues of the JOURNAL.

ARTHUR FENWICK HOLDING
1877–1949

BORN at Fort Edward, New York, on July 5, 1877, Arthur Fenwick Holding chose medicine as a career, and graduated from the Albany Medical College in the class of 1901. The versatile doctor was an intern at the Albany Hospital in 1901–1902. He did post-graduate work at Johns Hopkins Medical School in 1902–1903.

From 1903 to 1905 he was associated

Arthur Fenwick Holding

with Dr. W. R. Townsend, orthopedist in New York City. At that time he was instructor in surgery at Cornell University Medical College.

Returning to Albany in 1905, and remaining there until 1912, he conducted a private practice, and was lecturer in general and orthopedic surgery and roentgenology at the Albany Medical College.

In 1912 he was again in New York City occupying the post of assistant in surgery and roentgenology at Cornell University Medical College until 1915.

He did post-graduate work with Professor Schüller in Vienna in 1914.

Becoming interested in diseases of the eye, ear, nose and throat, he worked with Dr. George Dixon, Dr. J. M. Wheeler, and Dr. G. W. Jean of the New York Eye and Ear Infirmary; with Dr. Grigler at the Manhattan Ear, Nose and Throat Hospital; and with Dr. N. R. Dann at St. Bartholomew's Clinic.

The war period, 1917–1919, found him taking the U. S. Army course in neurological surgery; and later he served as surgeon with U. S. Base Hospital No. 63, A.E.F.

Following the war, he practiced for a time in Detroit, Michigan; but he returned to Albany in 1923, and established himself in private practice, specializing in diseases of the eye, ear, nose and throat. He married Miss Marguerite Griffin and settled down for the remainder of his life.

Dr. Holding maintained a lively interest in radiology; and, while he occupied the position of attending eye, ear, nose and throat surgeon at the Memorial Hospital, Albany, he also directed their roentgen therapy, and organized the hospital's tumor clinic. He became a member of the American Roentgen Ray Society in 1904.

At least six years before the Wilbur Report on the Cost of Medical Care, Dr. Holding was aware of the economic problems facing medicine, and was discussing with his colleagues ways and means of meeting them.

Twenty-five years ago, he was instrumental in establishing the first telephone exchange for doctors in Albany.

About April of 1945, he first developed

symptoms referable to swallowing, and a diagnosis of carcinoma of the esophagus was made in July, 1945. The tumor was removed surgically the same month, and he continued thereafter to practice, remaining in fairly good health for three years. A recurrence of the tumor, however, took place, finally causing his death on August 27, 1949.

William P. Howard, M.D.

JOHN RUSSELL CARTY
1892–1949

John Russell Carty died on July 12, 1949, in the Addison Gilbert Memorial Hospital in Gloucester, Massachusetts. He was born on July 29, 1892. His father, General John J. Carty, was the celebrated inventor and electrical engineer whose application and development of vacuum-tube amplification is credited with the present stage of perfection of long distance telephone operation. Dr. Carty's mother was Marion Mount Russell Carty. Annie Russell and Tommy Russell, well known on the stage in their time, were his aunt and uncle.

John Carty received the degree of B.S. from Princeton in 1917 and of M.D. from Cornell in 1921. Following a medical internship of two years in the New York Hospital, he served as X-ray house officer at the Peter Bent Brigham Hospital in Boston for a year beginning July 1, 1923. He then became an assistant in the department of radiology in the Massachusetts General Hospital from April to October, 1925, following which he returned to the Cornell Medical School as chief of clinic in radiology. When the school moved to its present location in the structure that houses also the New York Hospital, Dr. Carty became chief radiologist to the hospital and professor of radiology in the school. In 1944 illness forced him to vacate both positions. For twenty-four years I had occasion for close association with him, and I well remember the enthusiasm which he carried into such diverse problems as the fatigue of metal in cables suspending roentgenologic apparatus, with a view to preventing accidents; factors affecting the sensitivity of the skin of rabbits to radiation; improvement of the visualization of the gallbladder by the use of high-speed exposure, and numerous others.

At the New York Hospital, Dr. Carty was a special civilian instructor to medical

John Russell Carty

officers of the Navy. He contributed the chapter on Soft Tissue Radiography to the two-volume *Clinical Radiology* edited by Captain George N. Pillmore, and published

by the Navy in 1946. He was aided in this by Mrs. Carty, who assembled the source material and did the stenographic work. Her part in the work was recognized in a citation from Captain Pillmore.

Stricken at fifty-two by serious coronary impairment, Dr. Carty adjusted his life to his reduced physical capacity, and turned to painting. Even here his inventive mind found an outlet and he experimented on procedures to render paper a suitable base for oil paint. He maintained a studio in Forest Hills. The news of his death came as a sad surprise to his friends who had hoped that he had worked out a routine of life which he could carry on indefinitely.

Dr. Carty is survived by his wife, Mary Peirce Carty, and by two sons, John Russell Jr., and Winthrop P. Carty.

Ramsay Spillman, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Jefferson Hotel, St. Louis, Mo., Sept. 26–29, 1950.

AMERICAN RADIUM SOCIETY
Secretary, Dr. H. F. Hare, 605 Commonwealth Ave., Boston, Mass. Annual meeting: 1951, to be announced.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y., Annual meeting: Palmer House, Chicago, Ill., Dec. 10–15, 1950.

AMERICAN COLLEGE OF RADIOLOGY
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6. Annual meeting: San Francisco, Calif., June 25, 1950.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Paul C. Hodges, 950 E. 59th St., Chicago, Ill. Annual Meeting: San Francisco, Calif., June 26–30, 1950.

ALABAMA RADIOLOGICAL SOCIETY
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS
Secretary, Dr. R. Lee Foster, 507 Professional Bldg., Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

ARKANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

ATLANTA RADIOLOGICAL SOCIETY
Secretary, D. W. W. Bryan, 490 Peachtree St., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

CENTRAL OHIO RADIOLOGICAL SOCIETY
Secretary, Dr. Paul D. Meyer, Grant Hospital, Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Seneca Hotel, Columbus, Ohio.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

CINCINNATI RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio. Meets last Monday of each month, September to May, inclusive.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Hannan, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

COLORADO RADIOLOGICAL SOCIETY
Secretary, Dr. Paul E. RePass, 306 Republic Bldg., Denver 2, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

CONNECTICUT VALLEY RADIOLOGIC SOCIETY
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

DALLAS-FORT WORTH ROENTGEN STUDY CLUB
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. W. G. Belanger, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

EAST BAY ROENTGEN SOCIETY
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

FLORIDA RADIOLOGICAL SOCIETY
Secretary, Dr. F. K. Hurt, Riverside Hospital, Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

GEORGIA RADIOLOGICAL SOCIETY
Secretary, Dr. R. C. Pendergrass, Americus, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

GREATER MIAMI RADIOLOGICAL SOCIETY
Secretary, Dr. David Kirsh, 712 duPont Bldg., Miami 32, Florida. Meets last Wednesday of each month at 8:00 P.M. at Veterans Administration Regional Office.

HOUSTON X-RAY CLUB
Secretary, Dr. Curtis H. Burge, 3020 San Jacinto St. Houston 4, Texas. Meets fourth Monday each month.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

IOWA X-RAY CLUB
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. Special meetings by announcement.

KANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

KENTUCKY RADIOLOGICAL SOCIETY
Secretary, Dr. W. C. Martin, 321 W. Broadway, Louisville. Meets annually in Louisville on first Saturday in Apr.

KINGS COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

LOS ANGELES RADIOLOGICAL SOCIETY
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

LOUISIANA RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

* Secretaries of societies are requested to send timely information promptly to the Editor.

LOUISVILLE RADIOLOGICAL SOCIETY
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

MIAMI VALLEY RADIOLOGICAL SOCIETY
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

NEBRASKA RADIOLOGICAL SOCIETY
Secretary, Dr. J. E. Downing, 816 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. George Levene, Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday, Harvard Club.

NEW HAMPSHIRE ROENTGEN RAY SOCIETY
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. J. L. Olpp, 49 Ivy Lane, Tenafly, N. J. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

NORTH CAROLINA RADIOLOGICAL SOCIETY
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

NORTH DAKOTA RADIOLOGICAL SOCIETY
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB
Secretary, Dr. C. W. Wauters, 701 High St., Auburn, Calif. Meets at dinner last Monday, every second month, except June, July and August.

OHIO STATE RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio.

OKLAHOMA STATE RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Brown, Tulsa, Okla. Three regular meetings annually.

OREGON RADIOLOGICAL SOCIETY
Secretary, Dr. Selma Hyman, Univ. of Oregon Medical School, Portland, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M.

ORLEANS PARISH RADIOLOGICAL SOCIETY
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

PACIFIC ROENTGEN SOCIETY
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. G. P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY
Secretary Dr. F. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

QUEENS ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Goldstein, 88-29 163rd St., Jamaica 3, N. Y. Meets fourth Monday of each month except during the summer.

RADIOLOGICAL SECTION, BALTIMORE MEDICAL SOCIETY
Secretary, Dr. Harry A. Miller, 2452 Eutaw Place, Baltimore. Meets third Tuesday each month, Sept. to May.

RADIOLOGICAL SECTION, CONNECTICUT MEDICAL SOCIETY
Secretary, Dr. Fred Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY
Secretary, Dr. K. C. Corley, 1835 Eye St., N. W., Washington, D. C. Meets Medical Society Auditorium, third Thursday, Jan., March, May, Oct. at 8:00 P.M.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. Roy G. Giles, Temple, Texas.

RADIOLOGICAL SOCIETY OF NEW JERSEY
Secretary, Dr. Benjamin Copleman, 280 Hobart St., Perth Amboy, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. A. V. Winchell, 40 Meigs St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr. Meets Shirley-Savoy Hotel, Denver, Colo., Aug. 17, 18, 19, 1950.

ST. LOUIS SOCIETY OF RADIOLOGISTS
Secretary, Dr. H. R. Senturia, Pasteur Medical Building, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

SAN DIEGO ROENTGEN SOCIETY
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Wednesday at dinner.

SECTION ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

SECTION ON RADIOLOGY, ILLINOIS STATE MEDICAL SOCIETY
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

SHREVEPORT RADIOLOGICAL CLUB
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. S. H. Fisher, 107 E. North St., Greenville, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

TEXAS RADIOLOGICAL SOCIETY
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Next meeting, Galveston, Texas, January 19 and 20, 1951.

UNIVERSITY OF MICHIGAN DEPARTMENT OF ROENTGENOLOGY STAFF MEETING
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

UTAH STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-Ray Study Club of San Francisco
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets January to July, Lane Hall, Stanford University Hospital; and July to December at San Francisco Hospital.

Cuba, Mexico and Central America

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

Sociedad Radiológica Panameña
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86 Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary, Dr. E. M. Crawford, 1535 Sherbrooke St., West, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. I. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Asociacion Argentina de Radiologia
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

Sociedad Argentina de Radiologia
Secretary, Dr. Guido Gotta, Buenos Aires, Argentina. Meetings are held monthly.

Sociedad Argentina de Radiología, Filial del Litoral
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 7:00 P.M., 663 Italia St., Rosario.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Alliés, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Ceskoslovenská společnost pro röntgenologii a radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10.30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Măräcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad. USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin. Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky. Meets monthly, first Monday, 8 P.M.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Società Italiana di Radiologia Medica
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

PRELIMINARY PROGRAM

FIFTY-FIRST ANNUAL MEETING OF THE AMERICAN ROENTGEN RAY SOCIETY

THE Fifty-first Annual Meeting of the American Roentgen Ray Society will be held at the Hotel Jefferson, St. Louis, Missouri, September 26, 27, 28 and 29, 1950. This Fifty-first Annual Meeting is in reality the Fiftieth Anniversary of the organization of the American Roentgen Ray Society and therefore it should and will be of unusual interest not only to the members of the Society but to all those attending the meeting. The Committee on Local Arrangements has arranged a splendid program of entertainment and the Program Committee under the chairmanship of President-Elect Widmann has assembled a scientific program which should be of universal interest.

The Executive Council will meet at noon on Sunday, September 24, 1950.

The Annual Golf Tournament for the Willis F. Manges Trophy will be held at the Sunset Country Club on Monday, September 25, and the Annual Golf Dinner will also be held at the same Club at 7:30 P.M. on Monday evening. Tickets for the Golf Tournament and the dinner may be obtained at the Registration Desk at the Hotel Jefferson or at the Club.

The Caldwell Lecture will be given on Wednesday evening, September 27, and the Annual Banquet will be held on Thursday evening, September 28.

The Instructional Courses, which have been so adequately organized by the Director, Dr. Harry M. Weber, will begin at 8:30 A.M. on each day of the meeting. Elsewhere in this issue of the JOURNAL will be found the detailed plan of the Instructional Courses, and all those who are interested should look over the courses and order their tickets as soon as possible.

The Program Committee has set the time for presentation of papers and discussions as follows: *the presentation of a paper is limited to 20 minutes and the discussion of a paper to 5 minutes*, and it is earnestly requested that both the essayists and discussants hold themselves strictly to this allotted time.

The Scientific Program has been arranged as follows:

Tuesday, September 26, 1950

8:30 A.M. Instructional Courses.

10:00 A.M. Study of Scientific and Commercial Exhibits.

11:00 A.M. Call to Order, Fifty-first Annual Meeting, U. V. Portmann, M.D., President.

Presentation of Scientific Awards by the President.

Address of Welcome: Armond D. Fries, M.D., President of the St. Louis Medical Society.

Installation of the President-Elect, Bernard P. Widmann, M.D., Philadelphia Pa., by President Portmann and the Chairman of the Executive Council, Milton John Geyman, M.D., Santa Barbara, Calif.

Inaugural Address: President Bernard P. Widmann, M.D.

Fifty Years Ago—The Birth of the American Roentgen Ray Society. Edward H. Skinner, M.D., Kansas City, Mo.

Fifty Years of Trials and Tribulations in Radiology. George E. Pfahler, Philadelphia, Pa.

Fifty Years of Progress in Radiology. Arthur C. Christie, M.D., Washington, D.C.

2:00 P.M.

Paper No.

1. Review of Chemotherapy in the Treatment of Malignant Diseases and Leukemia. Edward Reinhard, M.D., St. Louis, Mo. (by invitation). Discussion by Carl V. Moore, M.D., St. Louis, Mo. (by invitation).

2. Observations and Results in the Treatment of Hyperthyroidism by Radioactive Iodine (I^{131}). Wendell G. Scott, M.D., William B. Seaman, M.D. (by invitation), Cyril MacBryde, M.D.

(by invitation), Leo Gottlieb, M.D. (by invitation), William Daughaday, M.D. (by invitation), and Bernard J. Sweeney, M.D. (by invitation), St. Louis, Mo.

Discussion by U. V. Portmann, M.D., Cleveland, Ohio.

3. Pericardial Effusion on the Lateral Roentgenogram. A Preliminary Report. Ross Golden, M.D., New York, N. Y.

Discussion by George Levene, M.D., Boston, Mass.

4. Subperiosteal Resorption of Bone. A Roentgenological Manifestation of Primary Hyperparathyroidism and Renal Osteodystrophy. David G. Pugh, M.D. Rochester, Minn.

Discussion by John F. Holt, M.D., Ann Arbor, Mich.

5. Roentgenographic Features of Slipped Capital Femoral Epiphysis. Armin Klein, M.D., Robert J. Joplin, M.D., John A. Reidy, M.D., and Joseph Hanelin, M.D., Boston, Mass. (all by invitation).

Discussion by Laurence L. Robbins, M.D., Boston, Mass.

6. Translumbar Arteriography as an Aid in Diagnosis of Disease of the Upper Urinary Tract. Parke G. Smith, M.D., Arthur T. Evans, M.D., Edward C. Elsey, M.D., and Benjamin Felson, M.D., Cincinnati, Ohio (all by invitation).

Discussion by Alvin Witt, M.D., St. Louis, Mo. (by invitation).

4:30 P.M. Executive Business Session of the Society.

Wednesday, September 27, 1950

8:30 A.M. Instructional Courses.

10:00 A.M. Study of Scientific and Commercial Exhibits.

11:00 A.M.

Symposium: The Training of Residents in Radiology. Moderator, B. R. Kirklin, M.D.

7. Introductory Remarks. B. R. Kirklin, M.D., Rochester, Minn.

8. Training in Diagnosis. Leo G. Rigler, M.D., Minneapolis, Minn.

9. Training in Therapy. Douglas Quick, M.D., New York, N.Y.

10. Training in Physics. Edith H. Quimby, M.S., Sc.D., New York, N. Y.

Discussion by Merrill C. Sosman, M.D., Boston, Mass., and H. Dabney Kerr, M.D., Iowa City, Iowa.

2:00 P.M.

11. Roentgenological and Pathological Manifestations of Antigenic Pneumonitis; Its Relationship to the Collagen Diseases. LeRoy Sante, M.D., and J. P. Wyatt, M.D. (by invitation), St. Louis, Mo.

Discussion by Fred J. Hodges, M.D., Ann Arbor, Michigan.

12. The Roentgen Diagnosis of Gliomas of the Brain. Eugene P. Pendergrass, M.D., Philip J. Hodes, M.D., and Daniel Talley, M.D. (by invitation), Philadelphia, Pa.

Discussion by Leonard T. Furlow, M.D., St. Louis, Mo. (by invitation).

13. Perigastric Adhesions and Bands Involving the Pyloric Antrum. Edward L. Jenkinson, M.D., and Ruskin C. Norman, M.D. (by invitation), Chicago, Ill.

Discussion by B. R. Kirklin, M.D., Rochester, Minn.

14. Roentgenologic Studies in Acute Bleeding from the Upper Gastrointestinal Tract. Max Ritvo, M.D., Thomas P. Cotter, M.D. (by invitation), and Norman Xamcheck, M.D. (by invitation), Boston, Mass.

Discussion by Aubrey O. Hampton, M.D., Washington, D. C.

15. The Roentgen Diagnosis of Clinically Significant Lesions of the Lower Esophagus in Infants. E. B. D. Neuhauser, M.D., and Martin Wittenborg, M.D. (by invitation), Boston, Mass.

Discussion by Ralph S. Bromer, M.D., Bryn Mawr, Pa.

16. Cephalopelvimetry. Frederick O. Coe, M.D., Washington, D.C.

Discussion by Paul C. Swenson, Philadelphia, Pa.

17. Diagnostic Kidney Puncture in Cysts and Tumors. Knut Lindblom, M.D., Stockholm, Sweden (by invitation).

Discussion by John F. Patton, M.D., St. Louis, Mo. (by invitation).

Wednesday Evening, September 27, 1950

Eight-Thirty O'Clock
The Caldwell Lecture
Henry L. Bockus, M.D.

Professor and Chairman of the Department of Internal Medicine
In the Graduate School of Medicine, University of Pennsylvania; Philadelphia, Pennsylvania.
"The Role of Roentgenology in Gastroenterology"
Introduction—W. Edward Chamberlain, M.D., Philadelphia, Pennsylvania.

Thursday, September 28, 1950

8:30 A.M. Instructional Courses.
10:00 A.M. Study of Scientific and Commercial Exhibits.
11:00 A.M.

Symposium: On Protection in Radiation. Moderator, Edith H. Quimby, M.S., Sc.D., New York, N. Y.

18. Protection in Diagnostic Radiology. Carl B. Braestrup, Ph.D., New York, N. Y. (by invitation).
19. Protection in Multi-million Volt Ranges. Lauriston S. Taylor, Ph.D., and Harold O. Wyckoff, Ph.D. (by invitation), Washington, D. C.
20. Disposal of Radioactive Wastes. Sergei Feitelberg, M.D., New York, N. Y. (by invitation).

Discussion by George C. Henny, M.Sc., M.D., Philadelphia, Pa., and Paul C. Aebersold, Ph.D., Oak Ridge, Tenn. (by invitation).

2:00 P.M.

Symposium: The Treatment of Carcinoma of the Cervix. Moderator, Juan A. del Regato, M.D.

21. The Role of Intracavitary Radium in the Treatment of Carcinoma of the Cervix. James A. Corscaden, M.D., New York, N. Y. (by invitation).
22. The Role of Interstitial Radium Therapy in the Treatment of Carcinoma of the Cervix. George W. Waterman, M.D., Providence, R. I. (by invitation).
23. The Role of Roentgen therapy in the Treatment of Carcinoma of the Cervix. Juan A. del Regato, Colorado Springs, Colo. (by invitation).
24. The Role of Surgery in the Treatment of Carcinoma of the Cervix. Joe V. Meigs, M.D., Boston, Mass. (by invitation).

Discussion by Simeon T. Cantril, M.D., Spokane, Wash. (by invitation), Edwin C. Ernst, M.D., and Axel N. Arneson, M.D., St. Louis, Mo. (by invitation).

4:30 P.M. Executive Business Session of the Society.

Thursday Evening, September 28, 1950

Seven-Thirty O'Clock
Annual Banquet

Friday, September 29, 1950

8:30 A.M. Instructional Courses.
10:00 A.M. Study of Scientific and Commercial Exhibits.
11:00 A.M.

25. Interpretation of the Recommendations of the International Committee on Radiologic Units Made to the Sixth International Congress of Radiology. G. Failla, D. Sc., New York, N. Y.

Discussion by Lauriston S. Taylor, Ph.D., Washington, D. C.

26. Dosage Calculations for Distribution Sources of Beta Radiations. H. H. Rossi, Ph.D., and R. H. Ellis, Jr., Ph.D., New York, N. Y. (both by invitation).

Discussion by L. D. Marinelli, Ph.D., Chicago, Ill. (by invitation).

27. Dosage Calculations for Carcinoma of the Cervix. Russell L. Nichols, M.D., and James W. J. Carpender, M.D., Chicago, Ill. (both by invitation).

Discussion by James F. Nolan, M.D., Los Angeles, Calif. (by invitation).

28. Electronic Amplification of the Flouroscopic Image. The Present Status of Moon's Scanning Tube Method. Paul C. Hodges, M.D., Chicago, Ill.

Discussion by Russell H. Morgan, M.D., Baltimore, Md.

2:00 P.M.

29. Clinical and Experimental Studies of the Detection of Brain Tumors with Special Reference to the Use of Radioactive Compounds. George Moore, M.D., Minneapolis, Minn. (by invitation).

Discussion by Henry Schwartz, M.D., St. Louis, Mo. (by invitation).

30. Diagnostic Use of Radioactive Isotopes. Lawrence Reynolds, M.D., Kenneth E. Corrigan, Ph.D., and H. S. Hayden, Ph.D. (by invitation), Detroit, Mich.
Discussion by Theodore P. Eberhard, M.D., Philadelphia, Pa. (by invitation).

31. The Value of Roentgen Therapy in Osteitis Pubis. Traian Leucutia, M.D., Detroit, Mich.
Discussion by Hugh F. Hare, M.D., Boston, Mass.

32. Endometriosis: Its Management and End Results. U. V. Portmann, M.D., and Robert A. Hayes, M. D. (by invitation), Cleveland, Ohio.
Discussion by Howard B. Hunt, M.D., Omaha, Neb.

33. Carcinoma of the Ovary. H. Dabney Kerr, M.D., and H. B. Elkins, M.D. (by invitation), Iowa City, Iowa.
Discussion by Harold W. Jacox, M.D., New York, N. Y.

34. Studies in the Use of Radioactive Gold in Patients with Cancer of the Reproductive Organs. Willard M. Allen. M.D., Alfred I. Sherman, M.D., and M. D. Bonebrake, M.D., St. Louis, Mo. (all by invitation).
Discussion by Otto Glasser, Ph.D., Cleveland, Ohio.

35. Problems in the Diagnosis and Treatment of Letterer-Siwe's Disease. Eugene L. Saenger, M.D., and Ralph J. Johansmann, M.D., Cincinnati, Ohio (both by invitation).
Discussion by Joseph C. Jaudon, M.D., St. Louis, Mo. (by invitation).

AMERICAN ROENTGEN RAY SOCIETY

SECTION ON INSTRUCTION

HARRY M. WEBER, M.D., *Director*

Titles and Abstracts of Courses Offered
Fifty-First Annual Meeting
Hotel Jefferson, St. Louis, Missouri
September 26–29, 1950

PRESIDENT-ELECT Widmann, with the approval of the Executive Council, has directed that the Section on Instruction be continued for the annual meeting of 1950. His program has been arranged so that the Instruction Courses will be offered between the hours of 8:30 A.M. and 10:00 A.M. on Tuesday, Wednesday, Thursday and Friday.

Fewer rooms are available for the purposes of the Section on Instruction than in previous years. Seven courses will be presented in each one of seven rooms, every day of the meeting. A total of 90 minutes has been made available for each course. This makes it possible for instructors to devote more time to discussion and to conference with those attending their courses. No other official activity has been scheduled for this time.

The Section on Instruction presents for 1950:

(1) Four courses (Courses 101, 102, 103, 104) one each day, dealing largely with Radiologic Physics, with a faculty of four instructors, and covering four periods.

(2) Seven single period courses in Therapeutic Radiology (Courses 201–207), with a faculty of eight instructors and covering seven periods.

(3) Seventeen single period courses in Diagnostic Roentgenology (Courses 301–317) with a faculty of fifteen instructors and covering seventeen periods.

GENERAL INFORMATION

The Faculty

Carl B. Braestrup, Senior Physicist, Department of Hospitals, New York City; Associate Professor of Radiology, New York University and Columbia University, New York, New York.

Ralph M. Caulk, M.D., Attending Radiologist and Medical Director of the Tumor Clinic, Garfield Memorial Hospital, Washington, D.C.

Fred O. Coe, B.S., M.D., Partner in the firm of Drs. Groover, Christie and Merritt, Washington, D.C.; Radiologist to Doctors Hospital.

Carroll C. Dundon, M.D., Assistant Clinical Professor of Radiology, Western Reserve University School of Medicine, Cleveland, Ohio.

Arthur W. Erskine, M.D., Cedar Rapids, Iowa.

Titus C. Evans, Ph.D., Head, Radiation Research Laboratory, College of Medicine, State University of Iowa, Iowa City, Iowa.

Otto Glasser, Ph.D., Professor of Biophysics; Head, Department of Biophysics, Cleveland Clinic Foundation, Cleveland, Ohio.

H. F. Hare, M.D., Radiologist, Lahey Clinic, Boston, Massachusetts.

Philip J. Hodes, B.S., M.D., D. Sc. (Rad.); Professor of Clinical Radiology, Medical School, University of Pennsylvania; Associate Professor, Graduate School of Medicine, University of Pennsylvania; Associate Radiologist to the Hospital of the University of Pennsylvania.

John W. Hope, M.D., Instructor in Radiology, University of Pennsylvania, Philadelphia, Pennsylvania.

H. Dabney Kerr, M.D., Professor and Head of Radiology, College of Medicine, University Hospital, State University of Iowa, Iowa City, Iowa.

B. R. Kirklin, M.D., F.A.C.P., F.A.C.R., Professor of Radiology, Mayo Foundation, University of Minnesota; Radiologist and Chairman of Sections on Radiology, Mayo Clinic, Rochester, Minnesota.

Knut Lindblom, M.D., Carolina Hospital, Stockholm, Sweden.

A. S. Macmillan, M.D., Radiologist, Massachusetts Eye and Ear Infirmary, Boston, Massachusetts.

Charles L. Martin, M.D., Professor of Radiology, Southwestern Medical College, Dallas, Texas.

Sherwood Moore, M.D., Professor Emeritus of Radiology, Washington University School of Medicine, St. Louis, Missouri; Former Director of the Edward Mallinckrodt Institute of Radiology.

Edward B. D. Neuhauser, M.D., Associate in Radiology, Harvard Medical School, Boston, Massachusetts; Radiologist to The Infant's and to The Children's Hospitals of Boston.

H. M. Parker, M.A., Ph.D., Manager of Health Instrument Divisions, General Electric Company Nucleonics Department, Richland, Washington.

P. B. Parsons, M.D., Radiologist, Norfolk General Hospital and United States Marine Hospital, Norfolk, Virginia, and Consultant in Radiology, United States Naval Hospital, Portsmouth, Virginia.

Harold O. Peterson, M.D., Clinical Associate Professor of Radiology, University of Minnesota, Minneapolis, Minnesota; Radiologist to Miller Hospital and Children's Hospital, Saint Paul, Minnesota.

Ernst A. Pohle, M.D., Ph.D., F.A.C.R., Professor of Radiology; Chairman, Department of Radiology, University of Wisconsin Medical School, Madison, Wisconsin.

David G. Pugh, M.D., Assistant Professor of Radiology, Mayo Foundation, University of Minnesota; Radiologist, Mayo Clinic, Rochester, Minnesota.

Edith H. Quimby, Sc.D., Associate Professor of Radiology (Physics), College of Physicians and Surgeons, Columbia University, New York, New York.

Robert J. Reeves, M.D., Professor of Radiology, Duke University Hospital, Durham, North Carolina.

L. R. Sante, M.D., Professor of Radiology, St. Louis University; Radiologist, St. Louis City Hospital, St. Louis, Missouri.

C. A. Stevenson, M.D., Head of the Department of Radiology, Scott and White Clinic, Temple, Texas.

John G. Trump, Sc.D., Associate Professor, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Conference Periods

Tuesday, Wednesday, Thursday and Friday mornings.

Single Periods.....8:30–10:00 A.M.

Location

All courses will be given in Parlors 1, 2, 3, 4, 7, 8, and 9, located on the Second Floor of the Hotel Jefferson. Full information will be obtainable at the registration desk of the Section on Instruction which will be found near the passenger elevators on the Second Floor. Attendants will be at this desk from 1 P.M. to 5 P.M. on Sunday, September 24, on Monday, September 25, from 8:30 A.M. until 4:30 P.M., and on the remaining days of the meeting from 8:00 A.M. until 5:00 P.M.

Code

The instruction periods will be designated with the following code:

T, Tuesday.....8:30–10:00 A.M.
W, Wednesday.....8:30–10:00 A.M.
Th, Thursday.....8:30–10:00 A.M.
F, Friday.....8:30–10:00 A.M.

How to Register and Obtain Tickets for the Instruction Courses

Admission to the Instruction Courses will be by ticket only.

Following the list of titles and abstracts is a general order sheet. First, second and third choices for each period should be selected carefully and indicated on the order sheet. The rooms in which the courses will be given are moderately large ones, but it will still be necessary to place a limitation on the number of persons who will be able to attend individual courses. It is estimated that the number who can attend will range between 60 and 125 persons. If the directions given on the order sheet

are followed explicitly, errors in completing reservations will be minimized.

It is possible for one to attend only four periods of instruction, so the condensed schedule given on the last pages of this program should be consulted with care when registering and ordering tickets.

Reservations will be made in the order in which the order forms are received. Those who are not members of the American Roentgen Ray Society will be charged the nominal fee of $1.50 per period of instruction, or a maximum fee of $5.00 for four periods. Full-time graduate students in Radiology will be admitted without fee, but they are required to make application for the courses they wish to attend.

Previous to September 12, 1950, the order forms should be sent to the Director, Dr. Harry M. Weber, Mayo Clinic, Rochester, Minnesota. After September 12, 1950, the orders should be sent directly to Dr. Harry M. Weber, Hotel Jefferson, St. Louis, Missouri.

To avoid the confusion always existing on the first days of the meeting, a set of tickets will be mailed to each person whose registration for courses reaches the office of the Director on or before September 12, 1950. The envelope containing the tickets will be labelled in a conspicuous manner. Registrants are urged to be on the lookout for their tickets, and to bring them to the meeting. The success of this innovation depends largely on the cooperation of the registrants.

In case the courses are not filled by the time of the meeting, tickets will be available at the registration desk on Sunday, September 24, and thereafter during the meeting.

Holders of Tickets

Those who do not have the proper ticket for the course they wish to attend will not be permitted to enter the room. Pages will be in attendance in each of the conference rooms to collect the tickets.

DESCRIPTION OF COURSES

I. Radiologic Physics

COURSE 101

Room 4 **Period: F**

CARL B. BRAESTRUP, Ph.D.,
New York, N. Y.

Common Causes of Radiation Hazards in Radiology

Radiation injuries are due mainly to improper operating procedures, faulty equipment, or inadequate structural shielding, These factors will be discussed in detail as they relate both to roentgenology and to radium therapy.

The protection recommendations of the new National Bureau of Standards Handbook 41 will be reviewed and illustrated with typical examples showing how radiation protection may be obtained most effectively and economically.

COURSE 102

Room 4 **Period: W**

TITUS C. EVANS, Ph.D.,
Iowa City, Iowa

Biophysical and Biochemical Effects of Ionizing Radiations

The differences between the interaction of material with ionizing and with non-ionizing radiation will be discussed briefly.

Our present concept of the mechanism whereby the energy in a roentgen-ray beam is transferred to tissue so as to produce first physical, then chemical, and finally biologic changes, will be discussed.

Mention will be made of the various theories of biologic action which attempt to stress the relative importance of the various processes whereby the radiation energy has been absorbed.

There will be a brief discussion of variation in, and modification of radiosensitivity. The factors of radiation intensity and radiation wavelengths will be discussed as regards their biologic effectiveness.

COURSE 103

Room 3 **Period: Th**

H. M. PARKER, M.A., Ph.D.,
Richland, Wash.

Radiation Dosimetry

1. Roentgen rays and gamma rays:
   Advantages of an ionization method.
   Interpretation of the original definition of the "roentgen."

Energy absorption and the Bragg-Gray Principle.
Interpretation of the current definition of the "roentgen."
The gamma-roentgen.
Complexities with multi-million volt radiation.

2. Other radiations:
Extension of the roentgen to particulate radiations.
Gray's Energy Unit.
The "rep."
Applications to radioisotope therapy and neutron therapy.
Other proposals for physical dose units.

3. Factors of biological effectiveness:
Relative biological effectiveness.
The "rem."
Scale of relation between "rep" and "rem."
Severe limitations of the "rem."

COURSE 104

Room 8 **Period: T**

EDITH H. QUIMBY, Sc.D.
New York, New York

The Radiologist and Radioisotopes

According to the Isotopes Distribution Plan of the Atomic Energy Commission, radioisotopes are allotted only to members of staffs of institutions properly equipped to sponsor their use. This implies in the institution the existence of a Radioisotope Committee, of which one member should be a therapeutic radiologist. It therefore behooves radiation therapists to become familiar with both the physical and medical fundamentals of the use of these substances.

The course will consist of a brief outline of:

a. The physical nature of radioisotopes;
b. Their uses in therapy;
c. Their uses in diagnosis and in allied problems;
d. Protection problems arising in their use;
e. Their procurement.

II. Therapeutic Radiology

COURSE 201

Room 9 **Period: W**

RALPH M. CAULK, M.D.,
Washington, D. C.

Radiation Therapy of Laryngeal Cancer

Excellent results from the standpoint of cure and restoration of voice can be obtained if a proper selection of cases for radiotherapy is made. This selection must be based upon the site of origin and extent of the disease. The diagnostic features, criteria for selection of cases for treatment, and results, will be presented, together with a recording of the voice of patients treated from four to sixteen years ago.

COURSE 202

Room 2 **Period: W**

ARTHUR W. ERSKINE, M.D.,
Iowa City, Iowa

Transvaginal Therapy of Cancer of the Cervix

The aim of radiation treatment of cancer of the cervix is the destruction of the primary lesion. Cancer of the cervix which has formed metastasis is for practical purposes not curable. Results of treatment with roentgen radiation will be presented. The advantages and disadvantages of radium therapy, the Chaoul technique, and the four major modifications of the transvaginal method will also be discussed. Data will be presented to show that the results of any method depend more upon the stage of the disease when treatment is begun than upon the special skill of the therapist.

COURSE 203

Room 4 **Period: T**

OTTO GLASSER, Ph.D.,
Cleveland, Ohio

Milestones in Radiology

Discussion of the discoveries of roentgen rays, natural radioactivity, the electron and radium in the late nineties of the last century will be preceded by a short presentation of the work on the production of high tension currents, the creation of highly evacuated tubes and the study of electrical discharges through such tubes carried out during the three centuries previous to Röntgen's discovery. Milestones in the development of medical radiology and radiation physics marking the work of such scientists as Rutherford, Planck, Einstein, Bohr, von Laue, Bragg, father and son, Millikan, C. T. R. Wilson, A. H. Compton, de Broglie, Coolidge for their scientific accomplishments during the first quarter of this century will be enumerated. This will be followed by a review of similarly great attainments during the second quarter. Events such as the invention of the cyclotron by E. O. Lawrence, the discovery of the neutron by Chadwick and of heavy hydrogen by Urey, of the positron by Anderson, were followed by the construction of high voltage electrostatic generators by Van de Graaff and the discovery of artificial radioactivity by the Joliots, production of new "trans-uranium" elements by Fermi, and discovery of atomic fission by Hahn and Strassman, construction of the betatron by Kerst. The latest additions to the great building of radiation

physics, the cyclo-synchroton, the proton synchroton, also called the bevatron or cosmotron, will be mentioned to bring the series of historical milestones in radiology up to date. In evaluating the great half century of progress in unraveling the secrets of radiant and atomic energy special emphasis will be laid on the interplay between pure physics and its application to medicine which has contributed so greatly to the astounding development of radiology.

COURSE 204

Room 8 **Period: Th**

HUGH F. HARE, M.D.,
Boston, Massachusetts

JOHN G. TRUMP, Sc.D.,
Cambridge, Massachusetts

Rotational Therapy Using 2 Million Volt Roentgen Rays: Physical and Clinical Aspects

This course will include a presentation of the techniques of rotation therapy, dosage distribution obtained in the irradiation of typical tumor sites, the physical and biological properties of roentgen rays over a wide energy range with emphasis on 2 million volt rays, considerations of total body dose and fractionation techniques, and clinical aspects and preliminary results of 2 million volt therapy using rotation on tumors of the pituitary, nasopharynx, larynx, lymph nodes of the neck, esophagus, breast, lung, and pelvic cavity.

COURSE 205

Room 2 **Period: Th**

H. DABNEY KERR, M.D.,
Iowa City, Iowa

Radiation Therapy of Intracranial Lesions, Neoplastic and Non-neoplastic

This course will be a discussion of the general philosophy of irradiation in neoplasms and other lesions of the central nervous system, and the pituitary body. The relative positions of neurosurgery and radiation will be discussed and emphasis will be laid on the need of cooperation between surgeon, neurologist and radiologist.

COURSE 206

Room 2 **Period: F**

CHARLES L. MARTIN, M.D.,
Dallas, Texas

Cancer of the Face, Mouth and Neck Treated with Irradiation Alone

All carcinomas of the face and mouth, regardless of their size, are treated with either roentgen therapy or low intensity radium needles. In many instances electrosurgery is used as a preliminary procedure to reduce the tumor to a flat plane or to remove involved cartilage. Metastatic lymph nodes in the neck are treated by a combination of roentgen therapy and low intensity radium needles. Details of technique, illustrative cases and statistical results will be presented with the aid of lantern slides.

COURSE 207

Room 2 **Period: T**

ERNST A. POHLE, M.D.,
Madison, Wisconsin

Radiation Therapy of Vascular Nevi

Vascular nevi of the skin may be divided into five groups: (1) capillary hemangiomas (port wine stain); (2) hemangioma simplex (strawberry mark); (3) cavernous hemangioma; (4) spider-like capillary telangiectasia; (5) lymphangioma. Treatment recommended by various authors consists of (*a*) injection with a sclerosing solution (quinine-urethane); (*b*) CO_2 snow; (*c*) radium; (*d*) roentgen rays; (*e*) desiccation. In the Department of Radiology at the University of Wisconsin we have used radium in the majority of our cases; roentgen rays occasionally, especially for large lesions; and desiccation for the spider-like nevus. The techniques of treatment and the results obtained will be discussed in detail.

III. Diagnostic Roentgenology

COURSE 301

Room 1 **Period: F**

FRED O. COE, M.D.,
Washington, D. C.

Cephalopelvimetry

A method of cephalopelvimetry is presented which possesses certain advantages not found in other methods.

The method is exact for pelvimetry.

The size and position of the skull can be determined in both cephalic and breech presentations.

The method is simple and easy for the technician.

Illustrative cases will be shown with a summary of the follow-up on outcome of delivery and measurements of infant skulls.

COURSE 302

Room 3 **Period: T**

CARROLL C. DUNDON, M.D.,
Cleveland, Ohio

Diseases of the Adrenal Glands

The origin, development, anatomy and function of the normal adrenal glands will be discussed briefly with a photograph of normal adrenal glands and air contrast demonstration of the normal glands in situ.

Diseases of the adrenal glands which can be demonstrated by roentgenograms include xanthomatosis, tuberculosis, primary and metastatic tumor of the adrenal glands. Cases of cardiac atrophy due to primary atrophy of the adrenal glands as well as involvement of the adrenal by amyloidosis are included, although the associated roentgenographic changes are secondary.

Tumors of the adrenal glands constitute the most important lesion of these organs which can be studied roentgenographically. Statistics regarding over 40 cases of adrenal tumors seen at the University Hospitals of Cleveland are presented. These include examples of all of the principal types of tumors such as neuroblastomas, one case of Cushing's syndrome, pheochromocytomas, androgenic cortical adenomas and carcinomas and malignant tumors causing no endocrine changes. Seven cases were studied by perirenal air injections and illustrate typical clinical histories, excellent roentgenographic demonstration of the tumors and operative findings.

The results obtained with irradiation and surgical treatment of adrenal tumors will be discussed.

COURSE 303

Room 7 **Period: T**

PHILIP J. HODES, M.D.

JOHN W. HOPE, M.D.,
Philadelphia, Pennsylvania

Manifestations of Intracranial Disease in Routine Roentgenograms

This session will start with a brief review of the classical manifestations of increased intracranial pressure. Special emphasis will be placed upon the recognition of the early changes. Mention will be made of the pitfalls in the diagnosis of intracranial disease.

The localizing manifestations of intracranial lesions will be discussed. The importance of changes in bone texture and abnormal vascularization will be commented upon. Bone erosions of the type seen in acoustic tumors and new bone proliferation of the type seen in meningiomas will receive particular emphasis.

Brief mention will be made of the normal and abnormal intracranial calcifications that help one in the recognition and localization of brain lesions.

(Approximately twenty minutes will be set aside for questions. Audience participation will be encouraged and we will be particularly anxious to see the routine skull films of any proved brain abnormality which may be submitted for diagnosis in an "Information Please" manner.)

COURSE 304

Room 7 **Period: W**

PHILIP J. HODES, M.D.

JOHN W. HOPE, M.D.,
Philadelphia, Pennsylvania

The Normal Encephalogram and Ventriculogram

The roentgen anatomy of the apparently healthy brain demonstrated in encephalograms and ventriculograms will be reviewed. The anatomical variants will be discussed as will also pitfalls in the use of these diagnostic modalities.

COURSE 305

Room 7 **Period: Th**

PHILIP J. HODES, M.D.

JOHN W. HOPE, M.D.,
Philadelphia, Pennsylvania

Cerebral Pneumography in the Diagnosis of Intracranial Disease

The manifestations of intracranial disease depicted in encephalograms will first be considered. The recognition of cerebral scars, porencephaly, cerebral atrophy, arachnoiditis, as well as space-taking lesions will be reviewed.

The use of ventriculograms in the diagnosis of intracranial lesions will be commented upon. After a brief review of the roentgen manifestations of the lesions of the cerebrum, special attention will be paid to lesions of the third ventricle and posterior fossa.

(Approximately twenty minutes will be set aside for questions. Audience participation will be encouraged and we will be particularly anxious to see the air studies of any proved brain abnormality which may be submitted for diagnosis in an "Information Please" manner.)

COURSE 306

Room 7 **Period: F**

PHILIP J. HODES, M.D.,

JOHN W. HOPE, M.D.,
Philadelphia, Pennsylvania

Cerebral Angiography

The roentgen anatomy of the vessels of the apparently healthy brain and its variants will be re-

viewed. Considerable time will be spent correlating the roentgen findings in brains injected at postmortem with their gross appearance at autopsy.

The vascular changes observed in intracranial disease will then be discussed systematically. Each portion of the brain will be reviewed separately in order to construct a logical picture. Having reviewed the localization of brain tumors, we will attempt to comment upon the relationship between vascular patterns and tumor types.

(Approximately twenty minutes will be set aside for questions. Audience participation will be encouraged and we will be particularly anxious to see cerebral angiograms of any proved brain abnormality which may be submitted for diagnosis in an "Information Please" manner.)

COURSE 307

Room 1 **Period: W**

B. R. KIRKLIN, M.D.,
Rochester, Minnesota

The Roentgenologic Recognition and Identification of Diaphragmatic Hernia

The technique of examination for the revelation and recognition of diaphragmatic hernia, as well as the classification of the various types of this abnormality, and the manner of identifying them, will be discussed and illustrated.

COURSE 308

Room 1 **Period: Th**

KNUT LINDBLOM, M.D.,
Stockholm, Sweden

(Two topics will be discussed in one period)

A. Myelography and Disc Puncture

For the demonstration of prolapse of the lumbar intervertebral discs it is important to visualize the main dural sac as well as the sheaths of the nerve roots. The sheaths can be completely filled with an opaque substance soluble in water. An aqueous solution of 20 per cent abrodil (skiodan), injected after a low lumbar anesthesia, has proved to be harmless and gives excellent roentgenograms of the lumbar subarachnoid space.

In spite of the improved results by myelography with abrodil (skiodan) the diagnosis in many cases of sciatic and low back pain has remained uncertain. In such cases the lower lumbar discs were punctured and injected with perabrodil (diodrast). The increased pressure in the discs caused pain; with ruptured and offending discs the whole lumbago-sciatic syndrome was reproduced. The distribution of the contrast media in the discs and in rupture and prolapse was studied in the roentgenograms.

Diagnostic disc puncture is used as a routine method for preoperative localization of all lumbar disc cases. It gives the most accurate knowledge of which disc or discs are responsible for the symptoms. It will probably replace lumbar myelography in most of the lumbago-sciatic cases.

B. Arthrography in Rupture of the Menisci and Ligaments of the Knee

Arthrography using a water-soluble contrast substance such as perabrodril or uroselectan has proved to be superior to arthrography using oxygen for the study of lesions of the menisci and ligaments of the knee joint.

Stereoscopic films in anteroposterior, oblique, and lateral projections are required.

The appearance of the menisci in the various projections must be compared in order to get a complete view of the ruptured structure. Sketches of cross sections of the menisci as seen in the various projections makes the interpretation easier.

Ruptures of the medial collateral ligament are seen in the arthrograms as medial caspular ruptures. These are usually permanent. Ruptures of the cruciate ligaments without bony fragments become demonstrable in the lateral arthrograms as deformities of the ligaments, especially in the chronic cases. Films illustrating the "drawer sign," which will be described and explained, are recommended.

Combined lesions of ligaments, menisci and condyles occur frequently. They are well demonstrated by arthrography.

Arthrography with perabrodil (diodrast) is harmless. Its importance is illustrated by the fact that at the Carolina Hospital in Stockholm it is a required procedure for the diagnosis of lesions of the menisci and ligaments of the knee.

COURSE 309

Room 8 **Period: F**

A. S. MACMILLAN, M.D.,
Boston, Massachusetts

Roentgen Examination of the Sinuses and Mastoids

Roentgen examination of the sinuses is a very important part of the diagnosis of pathology in these locations. The rhinologist is dependent upon a correct interpretation of the sinus roentgenograms. The findings should be reported in terms of pathology, and not in the indefinite roentgenological terms so often used. In this presentation, the technique of examination and interpretation will be considered as fully as time will allow.

The use of chemotherapy and antibiotics has greatly changed the course of infection in the mastoid. Pediatricians and general medical practitioners sometimes feel competent to treat this condition, but too often the treatment is inadequate. The roentgenologic examination of the mastoid is the

only dependable source of information. This should be recognized because mastoiditis is still prevalent. Acute and chronic infections of the mastoid and the complications will be discussed.

COURSE 310

Room 3 **Period: W**

SHERWOOD MOORE, M.D.,
St. Louis, Missouri

Morgagni's Syndrome and Hyperostosis of the Skull

Definition of conditions—literature—historical—(a) pre-roentgen and (b) post-roentgen eras—a study of the thickness of the calvaria in the normal and the hyperostotic cases—the accompanying symptomtology with a controlled group—the social and economic aspects of the hyperostotic individual—prognosis—discussion of theories of the etiology of the several forms of hyperostosis of the skull—conclusion.

COURSE 311

Room 9 **Period: T**

EDWARD B. D. NEUHAUSER, M.D.,
Boston, Massachusetts

Certain Aspects of the Gastrointestinal Tract in Infants and Young Children

In this course, no effort will be made to cover all the possible abnormalities and diseases that are seen or which reflect themselves in abnormalities of the alimentary tract.

Particular attention will be given to the technique of examination of the esophagus and gastrointestinal tract in infants and in young children and also to the technique of examination of the colon in infants.

Particular attention will be devoted to congenital anomalies and resulting diseases of the esophagus, certain unusual forms of herniation of the bowel into the thorax, and considerable attention will be given to the problems of duplication of the alimentary tract.

Malrotation of the bowel, congenital stenosis and atresia and study of the patient with imperforate anus will be discussed.

Several other anomalies and acquired lesions will be discussed briefly.

COURSE 312

Room 3 **Period: F**

PHILIP B. PARSONS, M.D.,
Norfolk, Virginia

Internal Abdominal Hernias

The subject of intra-abdominal herniation is reviewed. The mode of origin is discussed. Emphasis is placed on paraduodenal hernias, the incidence of which lesions is greater than the literature would indicate. Several signs are added for diagnosis of small hernias.

COURSE 313

Room 1 **Period: T**

HAROLD O. PETERSON, M.D.,
St. Paul, Minnesota

Spinal Myelography

This course will be divided into two parts. The first part will consist of a detailed description of the technique of pantopaque or lipiodol myelography primarily from the standpoint of doing the spinal puncture with the aid of fluoroscopic control so that the contrast medium can be properly injected and readily and completely aspirated. Minute details and tricks learned over a period of years will be discussed.

The second part of the course will deal with interpretation and differential diagnosis. Particular emphasis will be placed on the value of myelography in the diagnosis of herniated intervertebral discs. Deformities which are pathognomonic will be illustrated and contrasted with those which are not. The localization of spinal cord tumors will be covered as completely as possible. There will also be a demonstration on the recognition of subdural extra-arachnoid injections of contrast media as compared with subarachnoid and extra-dural injections.

COURSE 314

Room 9 **Period: Th**

DAVID G. PUGH, M.D.,
Rochester, Minnesota

The Diagnosis of Malacic Diseases of Bone

The roentgenologic diagnosis of abnormalities of bone resulting from certain endocrine and metabolic disturbances can often be made with accuracy. At times the diagnosis can be made on the basis of roentgenologic observations alone, but frequently the diagnosis can be made only by correlating laboratory data with the changes shown in the roentgenogram. Since roentgenologists are especially concerned with the diagnosis of skeletal lesions it is only proper that they be well acquainted with the physiologic changes that accompany malacic diseases and be able to aid referring physicians by suggesting the laboratory tests that are needed to supplement the roentgenologic manifestations. This course of instruction will present the roentgenologic manifesta-

tions of malacic diseases of bone, and special consideration will be given to their pathologic physiology.

COURSE 315

Room 4 **Period: Th**

ROBERT J. REEVES, M.D.,
Durham, North Carolina

Mycotic Infections of the Lungs and Their Systemic Complications

A brief survey of the more common types of fungi pathogenic to man.

(a) Geographic distribution
(b) Morphological appearance
(c) Immunological reactions and prognosis
(d) Mode of spread
(e) Roentgen appearance

Fungus infections of the lungs or osseous system are of such common occurrence in certain localities throughout the United States that it is necessary to consider mycotic disease in the differential diagnosis of practically every obscure infection. One of the greatest handicaps to the clinical and the roentgenological study of fungus infections is the confusion concerning the mycologic nomenclature of the fungi pathogenic to man. This confusion exists because in some localities the disease is relatively rare and, second, the mycologic laboratory is usually too far separated from the clinic.

Some of the more common endogenous mycoses may occur in any locality, in any climate and in any stratum of society.

COURSE 316

Room 9 **Period: F**

L. R. SANTE, M.D.,
St. Louis, Missouri

Acute Intestinal Obstruction and Related Abdominal Lesions

The roentgenological manifestations of acute intestinal obstruction and paralytic ileus are well accepted by most roentgenologists. Those attendant with spastic ileus from pain, localized ileus from infection, strangulated Richter's hernia, etc., introduce other factors which are not so clearly understood.

Roentgen observations in mesenteric thrombosis of both arterial and venous type give varying pictures which may, in certain cases, be of diagnostic value.

COURSE 317

Room 8 **Period: W**

CLYDE A. STEVENSON, M.D.,
Temple, Texas

The Conduct and Some Applications of the Roentgenologic Examination of the Colon

The roentgenologist is responsible for the detection of any organic lesion of the colon above the level of proctoscopic reach. Because of the marked normal variations in size, shape and position of the colon and because of the varied roentgenologic manifestations of disease no one type of examination is completely satisfactory for all conditions.

The discussion will be concerned with the most advantageous procedure in neoplastic, ulcerative and miscellaneous diseases of the colon. A method for the production of superior double contrast roentgenograms will be given in detail.

A printed outline and sample roentgenograms will be available for each registrant.

CONDENSED SCHEDULE OF COURSES ON TUESDAY, SEPT. 26

Code: T		Code: T	
Therapeutic Radiology and Radiation Physics		**Diagnostic Roentgenology**	
104—Quimby	The Radiologist and the Radioisotopes	**302—Dundon**	Diseases of the Adrenal Glands
203—Glasser	Milestones in Radiology	**303—Hodes and Hope**	Intracranial Disease as Manifested in Routine Roentgenograms
207—Pohle	Radiation Therapy of Vascular Nevi	**311—Neuhauser**	The Gastrointestinal Tract in Infants and Young Children
		313—Peterson	Spinal Myelography

CONDENSED SCHEDULE OF COURSES ON WEDNESDAY, SEPT. 27

Code: W		Code: W	
Therapeutic Radiology and Radiation Physics		**Diagnostic Roentgenology**	
102—Evans	Biophysical and Biochemical Effects of Ionizing Radiations	**304—Hodes and Hope**	The Normal Encephalogram and Ventriculogram
201—Caulk	Radiation Therapy of Laryngeal Cancer	**307—Kirklin**	Roentgenologic Recognition and Identification of Diaphragmatic Hernia
202—Erskine	Transvaginal Therapy of Cancer of the Cervix	**310—Moore**	Morgagni's Syndrome and the Hyperostoses of the Skull
		317—Stevenson	Conduct and Some Applications of the Roentgenologic Examination of the Colon

CONDENSED SCHEDULE OF COURSES ON THURSDAY, SEPT. 28

Code: Th		Code: Th	
Therapeutic Radiology and Radiation Physics		**Diagnostic Roentgenology**	
103—Parker	Radiation Dosimetry	**305—Hodes and Hope**	Cerebral Pneumography in the Diagnosis of Intracranial Disease
204—Hare and Trump	Rotational Therapy Using 2 Million Volt Roentgen Rays	**308—Lindblom**	(A) Myelography and Disc Puncture (B) Arthrography in Rupture of the Menisci and Ligaments of the Knee
205—Kerr	Radiation Therapy of Intracranial Lesions, Neoplastic and Non-neoplastic	**314—Pugh**	The Diagnosis of Malacic Diseases of Bone
		315—Reeves	Mycotic Infections of the Lungs and Their Systemic Complications

CONDENSED SCHEDULE OF COURSES ON FRIDAY, SEPT. 29

Code: F		Code: F	
Therapeutic Radiology and Radiation Physics		**Diagnostic Roentgenology**	
101—Braestrup	Common Causes of Radiation Hazards in Radiology	**301—Coe**	Cephalopelvimetry
206—Martin	Cancer of the Face, Mouth and Neck Treated with Irradiation Alone	**306—Hodes and Hope**	Cerebral Angiography
		309—Macmillan	Roentgen Examination of the Sinuses and Mastoids
		312—Parsons	Internal Abdominal Hernias
		316—Sante	Acute Intestinal Obstruction and Related Abdominal Lesions

HOTEL RESERVATIONS FOR THE ST. LOUIS MEETING

Those who are planning to attend the meeting of the American Roentgen Ray Society at the Hotel Jefferson in St. Louis, Missouri, September 26–29, 1950, are urged to make their hotel reservations as soon as possible, if they have not already done so. In the advertising section of this and several previous issues of the JOURNAL will be found an Application for Housing Accommodations. Reservations are being taken care of by the Hotels Convention Reservation Bureau, and while the hotels have promised adequate housing and are cooperating in setting aside sufficient rooms to take care of the members and guests who will attend the meeting, they will release all such unreserved space approximately thirty days prior to the meeting. Therefore, in order to secure adequate and satisfactory accommodations, there should be no delay in filling out and mailing one of the housing forms.

THE FIFTH INTERNATIONAL CONGRESS OF CANCER

While the unprecedented upheavals of World War II have not as yet entirely subsided, scientists from all corners of the earth will gather in Paris in July of this year, under the presidency of Doctor Antoine Lacassagne to seek the warmth of each other's thoughts and to offer generously the fruits of their own endeavors. Such is the common spiritual anxiety of identification; such is the noble aspiration to universality that characterizes science. And such is, also, the required common effort for the ultimate solution of a problem which no one claims as exclusively his own: for cancer travels without regard to frontiers or geographic accidents and exacts its inflexible taxation upon all races of men. Among the strong as among the weak, among the lavish as among the underprivileged, among the cultured as among the primitive, and among the ascetic as among the pagan, cancer reaps its perennial harvest in human life.

Since the incidence of cancer cannot be expected but to increase with the social and economic betterment of nations, and since preventive public health measures cannot affect that incidence in any serious degree, it is only through scientific research that we may hope for a reduction of its toll. Progress has been made in the treatment of cancer and the actual results obtained do not allow for undue defeatism, but our basic knowledge of this disease still lies deep in the night of ignorance. Around the world, most of the victims of cancer continue to hope that the disinterested search of men of science, with their tenacity and perseverance, may find a definite total solution to this biologic tragedy.

J. A. DEL REGATO, M.D.

CANCER RESEARCH PROGRAM

The cancer research program conducted by the Medical Division of the Oak Ridge Institute of Nuclear Studies in cooperation with the Southern medical schools will be in full operation by July 1, 1950. A small research staff has been assembled, and a 30-bed clinical unit, together with laboratories, treatment rooms, and radiation storage facilities has been constructed and equipped.

The program is designed to study the treatment of neoplasms through the use of radiation from radioactive isotopes. It is being financed by the Atomic Energy Commission through reimbursement under the Institute's contract with the A.E.C.

Patients to be treated will be selected and referred only by staff members of participating Southern medical schools. These are the Medical College of Alabama in Birmingham; the University of Arkansas School of Medicine in Little Rock; the Emory University School of Medicine in Atlanta; the University of Georgia College of Medicine in Augusta; the University of Kansas School of Medicine in Kansas City, Kansas; the University of Louisville School of Medicine in Louisville; the Louisiana State University School of Medicine in New Orleans; the Tulane University School

of Medicine in New Orleans; the University of Mississippi School of Medicine at University; the Bowman Gray School of Medicine of Wake Forest College, Winston-Salem, North Carolina; the Duke University School of Medicine at Durham; the University of North Carolina School of Medicine at Chapel Hill; the University of Oklahoma School of Medicine at Oklahoma City; the Medical College of the State of South Carolina at Charleston; Meharry Medical School at Nashville; University of Tennessee College of Medicine at Memphis; Vanderbilt University School of Medicine at Nashville; the Baylor University School of Medicine in Houston; the Medical Branch of the University of Texas at Galveston; the M. D. Anderson Hospital at Houston; Southwestern Medical College at Dallas; the Medical College of Virginia at Richmond; and the University of Virginia Department of Medicine at Charlottesville.

The physicians at these schools who will undertake to refer suitable patients will be guided by the principle that no patient will be considered for admission if the neoplastic condition is amenable to effective surgical or roentgen therapy. In view of the limited facilities only two or three types of neoplasms will be under study at any one time.

A Board of Medical Consultants exercises general supervision of the Institute program. It is comprised of Dean Wilburt C. Davison, School of Medicine, Duke University, Chairman; Dr. George T. Harrell, Professor of Internal Medicine, Bowman Gray School of Medicine; Dean Vernon W. Lippard, Department of Medicine, University of Virginia; Dr. Douglas H. Sprunt, Professor of Pathology, College of Medicine, University of Tennessee; Dean Roy R. Kracke, of the Medical College of Alabama, and Dr. Robert B. Taft, Professor of Radiology, Medical College of South Carolina.

OAK RIDGE SUMMER SYMPOSIUM

The second annual Oak Ridge Summer Symposium, devoted this year to quantum and inorganic chemistry, will be held at Oak Ridge, Tennessee, from August 21 to 31, 1950, under the joint sponsorship of the Oak Ridge National Laboratory and the Oak Ridge Institute of Nuclear Studies. The first symposium last year was in modern physics.

The program will include several lectures, each by distinguished chemists. In addition, there will be ample opportunity for participation in informal discussions by those attending the symposium. The symposium will be free of security restrictions and will be held in an air-conditioned building in downtown Oak Ridge.

There will be no admission for attendance; however, it is expected that those attending will arrange for their own traveling and living expenses. For those who may wish to combine attendance at the symposium with a vacation in East Tennessee, afternoons, Friday, Saturday, and Sunday will be free for informal discussions or recreational activities, depending upon the choice of the individual. There are several recreational points of interest in East Tennessee including the Great Smoky Mountains National Park and several of the TVA lakes.

Additional information on the symposium, housing, and restaurant facilities in and around Oak Ridge, and other material may be obtained from the University Relations Division, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tennessee.

CHICAGO ROENTGEN SOCIETY

The following officers have been elected for the Chicago Roentgen Society for the year 1950–1951: *President*, Dr. John H. Gilmore, Chicago; *Vice-President*, Dr. Frank L. Hussey, Chicago; *Secretary*, Dr. Benjamin D. Braun, Chicago.

CLEVELAND RADIOLOGICAL SOCIETY

The recently elected officers of the Cleveland Radiological Society for 1950–1951 are as follows: *President*, Dr. George R. Krause, Cleveland: *Secretary-Treasurer*, Dr. John R. Hannan, Cleveland.

NEW YORK ROENTGEN SOCIETY

The recently elected officers of the New York Roentgen Society for the year 1950–1951 are as follows: *President*, Dr. Robert P. Ball, New York; *Vice-President*, Dr. Maurice Lenz, New York; *Secretary*, Dr. John L. Olpp, Tenafly, N. J.; *Treasurer*, Dr. Irving Schwartz, New York.

SOUTH CAROLINA X-RAY SOCIETY

At the May meeting of the South Carolina X-Ray Society the following officers were elected for the coming year: *President*, Dr. W. S. Judy, Greenville, South Carolina; *Vice-President*, Dr. Percy D. Hay, Jr., Florence, South Carolina; *Secretary-Treasurer*, Dr. S. H. Fisher, Greenville, South Carolina; *Secretary-Treasurer*, Dr. S. H. Fisher, Greenville, South Carolina. At least two meetings are held each year, one at the annual meeting of the South Carolina Medical Association in May at Myrtle Beach, South Carolina, and others at the will of the President.

WASHINGTON STATE RADIOLOGICAL SOCIETY

At a recent meeting of the Washington State Radiological Society the following officers were elected for the coming year: *President*, Dr. Joseph M. Aspray, Spokane; *Vice-President*, Dr. Homer Hartzell, Seattle; *Secretary-Treasurer*, Dr. R. C. Kiltz, Everett, Washington.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

ROENTGEN-RAY EXAMINATION OF THE DIGESTIVE TRACT. By Ross Golden, M.D., Professor of Radiology, The College of Physicians and Surgeons, Columbia University; Director of the Department of Radiologic Service, The Presbyterian Hospital, New York. Cloth. Price $5.00, Pp. 358, with 117 illustrations. Thomas Nelson & Sons, 385 Madison Avenue, New York 17, New York, 1949.

The author has succeeded admirably in injecting into the text of his book so much of his own personality that one who has personal acquaintance feels as though he were conversing with him. The text is well organized, well balanced. The reproduction of the roentgenograms leaves little to be desired. The facts in relation to gastrointestinal roentgenology are so authoritative it seems a difficult task to offer criticism; none are suggested. The only points with which one could take issue relate to such minor matters that they are insignificant in view of the unquestioned value of the volume as a textbook and reference manual.

This material on the digestive tract is a part of the larger work on "Diagnostic Roentgenology," edited by the author of this section. It is convenient to have it in this handy form.

JAMES T. CASE, M.D.

DIFFERENTIAL DIAGNOSIS OF CHEST DISEASES. By Jacob Jesse Singer, M.D., F.A.C.P., F.C.C.P., Medical Director of the Rose Lampert Graff Foundation, Beverly Hills; Consultant in Chest Diseases, Cedars of Lebanon Hospital, Los Angeles, California; etc. Cloth. Price, $7.50. Pp. 344, with 171 illustrations. Philadelphia: Lea & Febiger, 1949.

The author has prepared an extensive review of the differential diagnosis of chest diseases from the viewpoint of an internist. It has been written, as he has stated, for the general practitioner. It is definitely not a roentgenographic study of chest diseases but is a clinical discussion of them and of the diagnostic methods that should be employed in solving each of the various disorders. This is a meaty volume for the average practitioner and represents a summary of the author's vast clinical experience in this field. In most instances his procedures, methods and conclusions are in agreement with routines that are employed in most medical centers. Some specialists in radiology and chest surgery may take issue with some of the author's didactic and dogmatic statements, but is realized that such statements are necessary to a certain extent in presenting a book in which the "aim has been for conciseness."

The volume serves as a ready handbook for the busy practitioner to refresh his knowledge of a particular disorder, but having read it he is not in a position to carry out the recommended procedures because in most instances they require training and experience, such as bronchography, bronchoscopy, thoracoscopy and the interpretation of difficult chest roentgenograms. Very rightly the author emphasizes the great importance of obtaining an accurate clinical history and performing a careful physical examination before proceeding with mechanical diagnostic aids.

The book is well organized, the illustrations are profuse and well reproduced with a brief but adequate text placed conveniently below. From the viewpoint of the radiologist the volume is a first-class primer and is not an advanced treatise for the specialist.

WENDELL G. SCOTT, M.D.

RETROPOSITION OF LUMBAR VERTEBRAE. *Acta chirurgica Scandinavica*, Supplementum 143. By Lars Hagelstam. Paper. Pp. 152, with numerous tables and illustrations. Tilgmanns Tryckeri, Helsingfors, 1949.

This monograph by a Finnish orthopedic surgeon deals with backward displacement of lumbar vertebrae. The author discusses the factors which may simulate such a displacement on roentgenograms, such as directing the central ray at too high a level, and rotation and/or sideward tilt of the spine during exposure, as illustrated by experiments made on a specimen. A large anteroposterior diameter of a vertebral body may also contribute to the visual impression of posterior shift; this is

shown by measurements on lateral views of the spines of a group of patients. An actual or real posterior displacement is usually the result of thinning of the subjacent intervertebral disc, due either to degeneration or to infection of that disc, including typhoid and tuberculous spondylitis.

The author believes that the position of the lumbar facets, which, because of their backward and downward slanting, force a vertebra to slide backward as it moves downward when the disc grows flat, is not primarily responsible for posterior displacement. He believes that muscle action and the tension of the ligamenta flava play a more important part, inferring this view from observations on patients and healthy persons with "instability" of the lumbar vertebrae during flexion and extension of the spine.

From a clinical point of view, posterior displacement is regarded as an accompanying sign of disc flattening rather than a cause of symptoms in itself.

The monograph, written in fluent English, reviews a problem of limited significance. The literature on the subject is discussed in the text, and there is a bibliography which includes many American papers. Eight roentgenograms of a specimen are reproduced. The book is well printed. It also contains a fine example of understatement. The author mentions in the preface that his work was begun in Finland in 1943. At that time, his country had been overrun after a desperate fight; it had been virtually at war for four years; and it was now caught between two powerful opposing war machines, with hardly any outside help, a decimated manpower, scant resources, little food, and a very slim chance of survival. The author alludes to none of this. He says: "The times were not congenial to scientific endeavours."

Albert Oppenheimer, M.D.

Practical Neurological Diagnosis. With Special Reference to the Problems of Neurosurgery. By R. Glen Spurling, M.D., Clinical Professor of Surgery (Neurosurgery), University of Louisville School of Medicine, Louisville, Kentucky. Fourth edition. Cloth. Price, $5.00. Pp. 268, with 101 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

Dr. Spurling has now completed the fourth edition of an extremely useful guide in carrying out a practical neurosurgical diagnosis. It should be of immense help not only to medical students, interns and residents but also to general practitioners who are interested in carrying out a routine neurologic examination. The book demonstrates a fairly simple but thoroughly practical manner of investigating patients afflicted with neurologic symptoms.

Dr. Spurling is a neurosurgeon of note with extensive practical experience. He has contributed much to the knowledge of neurosurgical problems. Perhaps his most noteworthy contribution has been the common sense treatment of herniated intervertebral discs. His efforts during World War II were of the utmost value to the younger neurosurgeons in the Army. The new fourth edition of "Practical Neurological Diagnosis" demonstrates his ability to survey neurosurgical diagnostic problems from a practical standpoint. The book will act as a guide to carry out adequate and chronological neurologic examinations by which one may determine whether further detailed neurosurgical investigation should be made.

The book has been divided into a study of the cranial nerves, the cerebrum, the cerebellum (which has been completely rewritten and should be of value to all neurosurgeons and neurologists), the spinal cord, the cerebrospinal fluid and roentgenologic diagnosis.

A glossary has also been introduced which is helpful in becoming acquainted with the terminology commonly used by neurologists and neurosurgeons.

The discussion of the neurosurgical problems associated with the spinal cord is particularly clear and concise.

The diagrams and illustrations are simple but descriptive.

The chapter devoted to roentgenographic studies could, perhaps, have been improved by the choice of roentgenograms that would reproduce more clearly so that the pathologic conditions described could be more clearly visualized. Unfortunately, the chapter on roentgenographic diagnosis, Chapter 8, omits an important new adjunct in diagnosis, namely arteriography. It would have been well worth while to mention arteriography as a valuable aid in roentgenographic diagnosis in certain cerebral vascular diseases.

It is the opinion of the reviewer that Dr. Spurling has made noteworthy revisions in the fourth edition of his book which has filled a great need and will continue to provide a wide

scope of usefulness to the medical profession. The publisher, Charles C Thomas, has again demonstrated his ability to produce a book of excellent quality.

James L. Poppen, M.D.

Cancer. Hérédité—Hormones—Substances cancérigènes. Tome I. Par Docteur J. Maisin, Professeur à l'Université de Louvain, Directeur de l'Institut du Cancer. Paper. Price, francs 84.—. Pp. 284, with numerous illustrations. Casterman, Tournai, Paris, France, 1948.

This splendid book by Professor J. Maisin is a complete review of the field of cancer from the point of view of experimental work on the etiology of this disease. It covers the entire field of experimental cancer research up to 1946. As one reads this compilation of experimental facts concerning the etiology of cancer in animals, and the great complexity of our detailed bits of data accumulated from countless laboratories, one has the feeling that biology in general and cancerology in particular need a Galileo and a Newton to find the common denominator and unifying basic principle which the reader feels must be present in this superabundance of isolated facts and empirical data.

To workers in the field of cancer research this should be a valuable book because of the particularly rich and well documented bibliography under each of the headings: Hormones, Heredity and Carcinogenic substances. This volume is soon to be followed by Volume II which will treat in like manner radiation, viruses and environment.

William M. Loehr, M.D.

Clinical Radiation Therapy. Edited by Ernst A. Pohle, M.D., Ph.D., F.A.C.R., Professor of Radiology, Chairman, Department of Radiology, University of Wisconsin, Madison, Wisconsin. Second edition, enlarged and thoroughly revised. Cloth. Price, $15.00. Pp. 902, with 201 illustrations and 1 colored plate. Philadelphia: Lea & Febiger, 1950.

The title of this book has been changed from Clinical Roentgen Therapy to Clinical Radiation Therapy. The Editor has widened the scope of the book by including more work on radium. In addition to radium being considered at appropriate places during the text, Dr. Charles L. Martin has included two supplements at the end of the book considering low intensity radium needles and dosage calculations in radium therapy.

Dr. Pohle is a well known radiologist and is thoroughly competent to act as editor of such a work. He has gathered together a number of excellent contributors and he has exercised the prerogative of an editor wherever he has thought it necessary for emphasis and clarity of thought.

The present volume is much more comprehensive than the first volume and it is excellently prepared. To those of us who knew Dr. Gordon E. Richards, it is pleasing to know that he was able to complete his contributions before his recent illness and death. This is the type of book that should be on the shelf of every radiologist whether he is beginning or experienced. The field covered in this volume encompasses almost the entire scope of radium and roentgen therapy, but does not include very much about isotopes. It is to be hoped that in a new edition of this book a comprehensive chapter on isotopes will be included.

The publisher is to be congratulated on the preparation of this volume. It is of a high order.

Eugene P. Pendergrass, M.D.

Das menschliche Knochenmark. Seine Anatomie, Physiologie und Pathologie nach Ergebnissen der intravitalen Markpunktion. Von Prof. Dr. Med. Karl Rohr, Universität Zürich. Zweite, umgearbeitete Auflage. Cloth. Price, DM 47.50. Pp. 404, with 143 illustrations. Georg Thieme, Diemershaldenstrasse 47, Stuttgart, Germany, 1949.

This book is a comprehensive and significant compilation of studies of human bone marrow. The views expressed are based not only on the author's own extensive experience of over three thousand sternal punctures but also on a thorough review of the world literature pertaining to the subject.

The book is divided into two parts. The first, or general part, includes the following: Historical review, technique of sternal puncture, embryology of the hemopoietic system, anatomy of the blood-forming organs, special cell morphology with detailed description of cell types and cell changes seen in bone marrow, physiology including regulatory mechanisms of cytogenesis, pathology of bone marrow and general hematologic principles.

The second, or special part, deals with diseases of the erythroid, myeloid, megakaryocytic and lymphocytic tissues. Panmyelophthisis is taken up next, followed by chapters on disturbances of the medullary reticulo-endothelial system, neoplasms involving bone marrow, and bone marrow changes seen in infectious diseases.

The subject material is amply illustrated by excellent black and white photomicrographs and superior colored reproductions. The subject is treated very extensively, particularly in the first part, and is up to date as shown by an extensive bibliography. However, although folic acid and vitamin B_{12} are briefly mentioned in connection with the megaloblastic anemias, references to these substances are omitted. No reference is made of the nitrogen mustards or the folic acid antagonists. Little more than one page is given to the iron deficiency anemias and similar space is devoted to the effects of radiation on the bone marrow.

The table of contents is well organized and gives helpful detailed subdivisions. The subject index of six pages, however, is inadequate for a book of this size. An author index is not included. The book is printed on excellent paper.

In general, this text is well prepared and organized, and beautifully illustrated. An attempt is made to seek generalizations and fundamental points of view, but interpretations are clearly differentiated from established observations. The book is of exceptional merit and should be of great value to all interested in bone marrow study.

Stefan S. Fajans, M.D.

Röntgen- und Radiumphysik für Mediziner. Von Dr. Richard Glocker, Professor für Röntgentechnik an der Technischen Hochschule Stuttgart. Cloth. Price, DM 19.80. Pp. 275, with 168 illustrations. Stuttgart: Georg Thieme, 1949.

The author of this book is a universal scientist in the field of radiology. As "Professor of Roentgen Technique" at the Stuttgart Technical High School he has not only explored thoroughly the field of roentgen-ray physics and technique but he has also for over thirty years contributed fundamental studies to the biological and medical application of roentgen rays and radiations from radioactive substances. Testimony to his former interest are numerous publications and notably his famous book "Materialprüfung mit Röentgenstrahlen," the third edition of which appeared last year. An equally large number of papers describe his interest in radiobiology and the book reviewed here is the condensed expression of his physicist's approach to medical radiology. The American reader of this book will experience a feeling of pride in recent contributions of American radiology to the pool of knowledge gathered in this field during the last ten years but he cannot help but admire also numerous contributions from other nations. Glocker's book describes some of them.

The author introduces his subject matter with some explanatory words on radiation and matter, a few data on historical milestones in radiology and a description of natural radioactivity. Within the space of a few pages he then delves into the more intricate principles of artificial radioactivity, stable and radioactive isotopes, the cyclotron, principles of "radioactive indicators" (tracer technique) and isotope therapy. This is followed by a sound discussion of the production of roentgen rays, construction of roentgen tubes and transformers, and the betatron (with the quaint German name name Elektronenschleuder, i.e. electron sling shot). Further chapters explain various properties of roentgen rays, roentgen-ray spectra, absorption, scattering, characteristic radiation, ionization in air and tissue, chemical and fluorescent effects. Dosimetry of radiation is discussed in great detail. Tolerance doses presented by the author for both roentgen and gamma rays are still of the order of 250 milliroentgens per day, i.e. almost as high as the recently adopted weekly permissible dose in this country. However, the author expresses the hope that the forthcoming Sixth International Congress of Radiology in London will arrive at universally acceptable standards for dosages of various types. Pocket protection chambers of the Victoreen or Lauritsen type are not discussed in the book, nor has the film monitoring protective service been given the hearty approval it deserves.

The physics of roentgen diagnosis is adequately covered, although some of the recently developed methods of arteriography, heart catheterization, and myelography are not mentioned. Chapters on roentgen therapy and on biological theories of the effect of ionizing radiations conclude this most stimulating book. A number of practical examples in an appendix

will attract the radiologist who has a knowledge of fundamental mathematics. Complete bibliographies, name and subject indexes are furnished. The book is highly recommended to radiologists who read German and who wish to review the fundamental basis of their science, as furnished by scientists of many countries during the last fifty and more specifically, ten, years.

Otto Glasser, Ph.D.

Tabellen zur Dosierung der Röntgenstrahlen. (Sonderbände zur Strahlentherapie. Band XXV. Herausgegeben von Professor Dr. Hans Meyer.) Von Professor Dr. Leonhard Grebe, Direktor des Röntgen-Forschungs-Instituts der Universität Bonn i. R., und Dr. phil. habil. Werner Wiebe. Privatdozent. Cloth. Price, DM 18.–. Pp. 152, with 6 illustrations. Urban & Schwarzenberg, Branitzer Platz 5, Berlin-Charlottenburg 9, Germany, 1950.

In 1930 Grebe and Nitzge published dosage tables for the use of radiologists in their daily work. That edition has been out of print for some time and since a definite demand for such tables has arisen the authors prepared a revised edition. The introduction discussing the measurement of the roentgen-ray intensity, laws of absorption, scattering, surface intensity and depth dose is very brief, but intentionally so, since the volume is meant primarily for the radiologist who is familiar with the fundamental principles of dosimetry. Data on sphere gap measurements, minimum wavelength, half-value layer, degrees of homogeneity and absorption in air, paraffin, water, Al, Cu, Zn and Pb are presented. The major portion of the book is devoted to dosage tables giving doses for various depths for fields of 50–400 cm^2. and a wide range of qualities of radiation identified by the half-value layer in copper or aluminum. Spot checks seem to indicate that most figures are in fair agreement with those used in this country. As the authors state in the foreword, all doses were corrected according to information obtained from the recent literature; they are not based on measurements of their own.

The perusal of the tables does not require an extensive knowledge of the German language and the book should prove useful in the radiologist's daily dosage computations.

Ernst A. Pohle, M.D.

BOOKS RECEIVED

Cytologic Diagnosis of Lung Cancer. By Seymour M. Farber, M.D., Milton Rosenthal, M.D., Edwin F. Alston, M.D., Mortimer A. Benioff, M.D., and Allen K. McGrath, Jr., M.D. From the University of California Medical Service and the Department of Pathology, San Francisco Hospital and the San Francisco Department of Public Health. Cloth. Price, $6.00. Pp. 59, with 60 illustrations on 10 plates. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

Das menschliche Knochenmark. Seine Anatomie, Physiologie und Pathologie nach Ergebnissen der intravitalen Markpunktion. Von Prof. Dr. Med. Karl Rohr, Universität Zürich. Zweite, umgearbeitete Auflage. Cloth. Price, DM 47.50. Pp. 404, with 143 illustrations. Georg Thieme, Diemershaldenstrasse 47, Stuttgart, Germany, 1949.

The Causation and Treatment of Delayed Union in Fractures of the Long Bone. By Kenneth W. Starr, O.B.E., E.D., M.B., B.S. (Syd.), M.S. (Melb.), F.R.C.S. (Eng.), Surgeon, Sydney Hospital, New South Wales; Visiting Surgeon, Concord Military Hospital; Consulting Plastic Surgeon, Faculty of Dentistry, University of Sydney; Member of the Court of Examiners, Royal Australasian College of Surgeons; Lt.-Col. (R. of O.), A.A.M.C., late Officer Commanding Surgical Division. Cloth. Price, $9.00. Pp. 215, with 106 illustrations. Butterworth & Co., Ltd., 4–6 Bell Yard, Temple Bar, London, England; The C. V. Mosby Company, 3207 Washington Boulevard, St. Louis 3, Missouri, 1947.

Radiologia Austriaca. Herausgegeben von der Österreichischen Röntgen-Gesellschaft. Band II. Cardboard. Pp. 276, with 93 illustrations. Urban & Schwarzenberg, Frankgasse 4 (Schliessfach 4), Wien, IX/71, 1949.

Clinical Radiation Therapy. Edited by Ernst A. Pohle, M.D., Ph.D., F.A.C.R., Professor of Radiology, Chairman, Department of Radiology, University of Wisconsin, Madison, Wisconsin. Second edition, enlarged and thoroughly revised. Cloth. Price, $15.00. Pp. 902, with 201 illustrations and 1 colored plate. Lea & Febiger, Washington Square, Philadelphia 6, Pennsylvania, 1950.

Tabellen zur Dosierung der Röntgenstrahlen. Sonderbände zur Strahlentherapie, Band XXV. Von Professor Dr. Leonhard Grebe, Direktor des Röntgen-Forschungs-Instituts der Universität Bonn i. R., und Dr. phil habil. Werner Wiebe, Privatdozent. Cloth. Price, geh. DM 15.–, geb. DM 18.–. Pp. 152, with 6 illustrations. Urban & Schwarzenberg, Berlin-Charlottenburg 9, Branitzer Platz 5, Germany, 1950.

Carcinoma of the Larynx. British Journal of Radiology, Supplement No. 3. By F. Baclesse, M.D., "Chef de Service" of the X-ray Department, Foundation Curie, Paris. Delivered at the meeting of the British Institute of Radiology, held at the French Institute in London on March 21, 1947. With a Statistical Report on Cases Treated with X Rays Only. By R. W. Gunderson, B.Sc., D.M.R.T., F.R.C.S. (Eng.), The Meyerstein Institute of Radiotherapy, The Middlesex Hospital, London W.1. Paper. Price, 25s. Pp. 68, with numerous tables and illustrations. Published by the British Institute of Radiology, 32, Welbeck Street, London, England, 1949.

Cancer of the Breast. A Clinical Study of 1042 Cases Treated at Radiumhemmet, 1936-1941. *Acta radiologica*, Supplementum LXXVII. By Bengt A. Nohrman. Paper. Pp. 98 with 64 tables. Esselte Aktiebolag, Stockholm, Sweden, 1949.

La Radioterapia dei Fibromiomi Uterini in Rapporto Agli Altri Metodi Terapeutici. By Dr. Giovanni Gardella (Assistente Vol.). Comunicato in parte al XLI° Raduno dei Radiologi Emiliani e Marchigiani, Bologna 13–14 ott. 1948. Paper. Pp. 63. Scuola Tipografica Opera SS., Vergine di Pompei, Genova, Italy, 1948.

Queensland Radium Institute. Fifth Annual Report to the Honourable the Minister for Health and Home Affairs. For the Year Ended 30th June, 1949. Paper. Pp. 21. A. H. Tucker, Government Printer, Brisbane, 1949.

Air Pollution in Donora, Pa. Epidemiology of the Unusual Smog Episode of October, 1948. Preliminary Report. Public Health Bulletin No. 306. By. H. H. Schrenk, Harry Heimann. George D. Clayton, and W. M. Gafafer, U. S. Public Health Service; and Harry Wexler, U. S. Weather Bureau. Paper. Pp. 173, with over 90 illustrations. Federal Security Agency, Washington, D. C., 1949.

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. LEUCUTIA, M. D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

NECK AND CHEST

Isaac, Frank, and Ottoman, Richard E. Cavitary form of pulmonary neoplasm. *Radiology*, May, 1949, *52*, 662–668.

Because pulmonary neoplasm produces no pathognomonic sign, either clinical or roentgenological, early differential diagnosis between inflammatory and malignant lesions of the lung is not always possible. One of the most important steps toward early diagnosis is roentgenologic study, and one of the types of lung cancer often confused with infection is the cavitary form.

Body section roentgenography may prove helpful by demonstrating that the cavity is eccentric and that the contour of the inner wall is irregular, ragged, or "bumpy." Summation of shadows in the same sagittal planes obscures the findings in chest films taken with the Potter-Bucky diaphragm in the supine position. In the conventional chest film taken in the erect position, fluid is an additional cause of obscuration.

The findings are neither pathognomonic nor invariable. They are found in other conditions, especially tuberculous cavities, and are not always found in cavitary cancers. But their demonstration strengthens suspicion of cancer.

In 4 of the 5 cases reported, the correct diagnosis was suggested by the roentgenologist.—*George Cooper, Jr., M.D.*

Berning, Hermann. Zur Klinik der benignen Bronchialtumoren, insbesondere der sogenannten Bronchialadenome. (Clinical observation of benign bronchial tumors, especially of so-called bronchial adenomas.) *Neue med. Welt*, March 11, 1950, *1*, 352–355.

The clinical course of benign bronchial tumors can be divided into three stages.

Stage one: Hemoptyses are frequent; there are few symptoms; blood pattern and sedimentation rate are normal; there is no fever. Early roentgen findings of partial bronchial stenosis may be present. During fluoroscopic observation the mediastinum can be shifted by blowing the nose towards the diseased side, while on coughing the shift is towards the normal side. Minimal signs of obstructive emphysema or atelectasis can occasionally also be seen.

Stage two: Hemoptyses persist and there are more definite signs of bronchostenosis; there is recurrent atelectasis with or without pleurisy. Obstructive emphysema, changes in the excursion and height of the diaphragm are seen. During expiration the mediastinum is shifted to the unaffected side and returns to normal during inspiration.

Stage three: The signs are those of complete bronchial obstruction, associated at times with bronchiectasis. Lung abscess and emphysema can be found as complications. A permanently atelectatic lung may be present. Mediastinal and diaphragmatic changes are more pronounced than in stage two.

Fluoroscopy, roentgenography, bronchography, and tomography offer diagnostic help. The most valuable procedure is bronchoscopy and biopsy.

During the early stages bronchoscopic eradication may be possible. Roentgen therapy has not been successful, according to the literature,

while local radium application may be of some help. In later stages lobectomy or pneumonectomy is the procedure of choice.—*Hans W. Hefke, M.D.*

Naclerio, Emil A., and Langer, Lazaro. Adenoma of the bronchus; review of 15 cases. *Am. J. Surg.*, 1948, *75*, 532–547.

The authors reviewed all the cases of bronchial adenoma and carcinoma treated by Dr. Richard H. Overholt since 1933. In this group there were 305 histologically verified cases of pulmonary carcinoma and 15 cases of bronchial adenoma. Bronchial adenoma constituted 3.6 per cent of the patients considered. Of the 305 cases of pulmonary carcinoma, 50 had a curative resection. Of the 15 cases of bronchial adenoma, 3 had lymph node metastases and 12 were considered curative resections. The authors point out that among the curable bronchial neoplasms, adenoma comprises about one-fourth of the group.

The 15 cases are reported in some detail with good reproductions of the roentgenograms and the gross and microscopic pathology.—*V. P. Collins, M.D.*

Moersch, Herman J., and McDonald, John R. Bronchial adenoma. *J.A.M.A.*, Feb. 4, 1950, *142*, 299–304.

This report is based on the observations in 86 consecutive cases having microscopic diagnosis of removed tumor tissue. The age of the patients varied from fifteen to sixty-seven years with the average age of females thirty-eight and males forty-two years, with no sex preponderance. Symptoms in order of frequency were cough, hemoptysis, pain, chills and fever, dyspnea, and wheeze. The most common sites were the main and lower lobe bronchi, but all major lobe bronchi were involved among the various cases cited.

Routine roentgen studies were of importance in 74 per cent of the cases with additional help from tomography and bronchography. Bronchoscopy permitted visualization of the adenoma in 78 patients, or 91 per cent of the cases, with positive biopsy material obtained at bronchoscopy in 75 of the 78 cases. Grossly all adenomas tend to polypoid projection into the lumen of the bronchus, but in about 90 per cent infiltration was present in and around the bronchial wall.

Tumors are grouped into two types, on the basis of the clinical course and the general appearance of the tumor: 90 per cent, or 77 of the 86 cases, were of the carcinoid type, and 9 cases, or 10 per cent, of the cylindroma type. The carcinoid type tumors present one of several histopathologic patterns, one of which is a predominantly vascular tumor. This type of tumor is red and appears hemorrhagic and hemoptysis is frequent. Other tumors are less vascular and more solid. In both types of adenoma the mucosa is intact over the tumor. Hemorrhage, when it occurs, must result from a break in the mucosa overlying the tumor, but this rapidly heals over. The intact mucosa explains why cytologic study of the sputum consistently gives negative results in these tumors.

These tumors metastasize and 5 of the patients had definitely proved metastasis, while in 3 other cases it seemed probable, but not proved microscopically.

Treatment: 45 by lobectomy or pneumonectomy, 6 by operative intervention or intervention and by endoscopy, 5 by roentgen therapy. Of those treated by roentgen irradiation (all during the earlier period of study) 2 were living and apparently well fifteen and eighteen years later, 1 living fifteen years later but having difficulty, 2 died (1 at six years and 1 at two years) after treatment. It is the authors' impression that the carcinoid type responds better than the cylindroma type.

From the pathologic point of view the cylindromas have, as a rule, a wider base of attachment and present a more difficult therapeutic problem than do the adenomas of the carcinoid type. The most satisfactory results are obtained in surgical extirpation in suitable selected cases. The adenoma which is pedunculated and situated in a bronchus from which its removal can be accomplished is best treated bronchoscopically. In the older patients, with lesion close to the carina so that a pneumonectomy would be required are also best treated bronchoscopically. These patients must be subjected to repeated bronchoscopy because of the possibility of recurrence. Surgical treatment is advisable in all other cases and in cases in which the tumor shows evidence of recurrence. —*R. K. Arbuckle, M.D.*

Vest, M. Aplasie des Ober- und Mittellappens der rechten Lunge mit Hypoplasie der Lungenarterie und Dextrocardie. (Aplasia of the upper and middle lobe of the right lung with hypoplasia of the pulmonary ar-

tery and dextrocardia.) *Ann. paediat.*, Aug., 1949, *173*, 65–79.

The clinical and autopsy findings of a nine month old infant with aplasia of the right upper and middle lobe are described. The differential diagnosis between pulmonary aplasia or hypoplasia and atelectasis is difficult in many instances. The author emphasizes that under these circumstances the occurrence of other malformations usually points toward an anomalous development of the lung. The following malformations are known to have occurred in association with pulmonary aplasia or hypoplasia: cardiovascular anomalies, imperforate anus, malformations of the hands and spine, dystopia of the kidney, and developmental defect of the diaphragms.

In the case recorded in this paper the faulty development of the right lung was found to be associated with cardiac anomalies (high ventricular septem defect, open foramen ovale), hypoplasia of the pulmonary artery and bilateral hydroureters. The etiology and pathology of the malformation is briefly discussed.—*H. S. Weens, M.D.*

Rutledge, David I. Approach to the diagnosis of the common types of congenital heart disease. *J.A.M.A.*, Dec. 31, 1949, *141*, 1290–1297.

Congenital heart disease should be suspected when a cardiac murmur has been present since infancy, when cyanosis has occurred in childhood, or when hypertension is found in a young person.

In 100 cases of congenital heart disease seen at the Lahey Clinic, 92 fell into four major groups: (1) septal defects; (2) coarctation of the aorta; (3) patent ductus arteriosus; (4) tetralogy of Fallot. In most instances conventional studies were enough to make the diagnosis, but in obscure cases three special laboratory studies were used. They are: 1. Catheterization of the heart permitting assay of blood samples for oxygen content as well as obtaining pressure readings at various locations, and determining the blood flow between the lesser and greater circulations. These all help indicate a shunt of blood from the left to the right side of the heart or obstacles to normal blood flow. 2. The standard exercise of Bing which measures expired air and determines the ratio between the oxygen consumed and the amount of air ventilated by the lungs. When it is impossible to increase the pulmonary flow during exercise, as in stenosis of the pulmonic valve or tricuspid valve atresia, there will be a fall in this ratio rather than an increase. 3. Angiocardiography using 70 per cent diodrast is reserved at the Lahey Clinic for coarctation of the aorta as a means of giving the surgeon some knowledge of what he will find at surgery.

Septal defects formed 48 per cent of the entire group, the auricular lesions being most common. The diagnosis of auricular septal defect was considered when there was a loud, harsh systolic murmur along the left sternal border in a non-cyanotic underdeveloped patient who had right axis deviation, a prominent, pulsating pulmonary artery and a large right ventricle. Differentiation from patent ductus arteriosus was made by the presence of right axis deviation in auricular septal defect. It was differentiated from pulmonic stenosis with a dilated pulmonary artery by means of the standard exercise test.

Ventricular septal defect was suspected when there was a loud, harsh systolic murmur along the left sternal border, widely transmitted and usually accompanied by a thrill, with little change in the size and shape of the heart or in the electrocardiogram. The treatment of septal defects is medical.

Coarctation of the aorta was considered when there was a difference in the blood pressure of the upper and lower extremities with reduced pulsation of the abdominal aorta and femoral arteries, and a rough systolic murmur heard in the back as well as along the left sternal border. Notching of the undersurface of the ribs was confirmatory. The treatment was surgical.

Patent ductus arteriosus was considered when the patient had a loud, continuous, humming murmur heard best at the pulmonic area with an associated reduction in diastolic pressure. Fluoroscopy usually showed an enlarged left ventricle and an enlarged, pulsating pulmonary artery. Auricular septal defect and pulmonic stenosis with a dilatation of the pulmonary artery may present a murmur and a fluoroscopic picture similar to patent ductus arteriosus, but catheter studies or the standard exercise test distinguished between the conditions. The treatment was surgical.

The tetralogy of Fallot was suspected when there was cyanosis in one living beyond the first few years of life with a rough systolic murmur, right axis deviation, and with an

enlarged right ventricle and a small pulmonary artery on fluoroscopy. Eisenmenger's complex, which is similar except for the absence of pulmonic stenosis, is differentiated by the presence of a dilated pulmonary artery which has a pressure equal to that of the right ventricle rather than lower as is found in the tetralogy of Fallot. The standard exercise test was also helpful since the ratio of oxygen consumption during exercise increased with Eisenmenger's complex and decreased in the tetralogy of Fallot. The treatment was surgical.—*C. Colangelo, M.D.*

Donzelot, E., Heim de Balsac, R., Emam-Zade, A-M., and Escalle, J. E. Anatomie radiologique et interprétation des angiocardiographies. (Roentgen anatomy and interpretation of angiocardiograms.) *Presse méd.*, June 15, 1949, *39*, 535–536.

The authors call attention to fundamental work done on establishing the roentgen anatomy of the heart and great vessels by special and careful injections of these structures on the cadaver. (Heim de Balsac *et al.*, 1936). Excellent illustrations of such experimental observations made postmortem are reproduced and serve as a splendid reference for the normal anatomical structures outlined during angiocardiography. A thorough knowledge of the normal roentgen anatomy of the heart and great vessels is indispensable to correct interpretations of angiocardiograms and this article, although brief, gives many fine illustrations and cites earlier French papers where more complete studies on the cadaver may be found. —*William M. Loehr, M.D.*

Gore, Ira, and Arons, Walter. Calcification of the myocardium; pathologic study of thirteen cases. *Arch. Path.*, July, 1949, *48*, 1–12.

Thirteen cases of calcification of the heart muscle collected by the Army Institute of Pathology have been studied and reviewed by the authors. The precipitation and demonstration of calcium salts in myocardial muscle is extremely rare. The calcification which is present in these 13 cases is considered to be the dystrophic as contrasted with the metastatic type. In these cases no reference is made to ante-mortem diagnosis by means of roentgenology, but in all cases a gritty sensation was noted at autopsy when the muscle was incised. The paper is well illustrated with low and high power photomicrographs showing deposits of calcium in necrotic myofibrils. It is felt by the authors that calcification does not occur in normal heart muscle but is precipitated in previously damaged or necrotic heart muscle fibers under certain conditions which accelerate the deposition of calcium salts, such as azotemia which occurred in 12 of the 13 cases. Other factors which may increase precipitation of salts in the heart muscles are ischemia and excessive intake of vitamin D.—*C. L. Hinkel, M.D.*

Haubrich, R., and Thurn P. Zur Röntgendiagnostik der valvulären Herzkonfigurationen. (Roentgen diagnosis of heart configurations due to valvular disease.) *Deutsche med. Wchnschr.*, Jan. 27, 1950, *75*, 147–149.

The author contends that, with few exceptions, there are typical changes in heart contour in the presence of definite valvular disease. In aortic valvular disease, there is a characteristic enlargement of the left ventricle forming the shape of a shoe. Also, due regard must be paid to the width and length of the aorta in considering this condition. In mitral stenosis, there is an enlargement of the left auricle and usually also of right ventricle, with rotation of the heart to the left. The aortic knob becomes less prominent and the left ventricle convexity is straightened and flattened. The lung roots are widened due to increase in pulmonary pressure. There are rare instances of mitral stenosis, where no left auricular enlargement can be made out by the usual diagnostic procedures. This may be true even though there is a hypertrophy of the right ventricle due to increase in pressure of the lesser circulation. In mitral insufficiency, the heart configuration is much less typical. The left ventricle may be the only chamber to show enlargement. Also, the left auricle may often be enlarged. The total picture will depend upon the amount of muscle damage present in the individual case.—*S. Richman, M.D.*

ABDOMEN

Hernberg, C. A. Roentgenological visualization of the fish tapeworm, Diphyllobothrium latum, in the intestine of man. *Acta med. Scandinav.*, Aug., 1949, *135*, 138–141.

Von Bonsdorff demonstrated that the high or low position of the fish tapeworm is of decisive importance in determining whether the

patient develops pernicious anemia. He used an intestinal tube inserted at various levels to determine the level of worm eggs or proglottides, and the worm was considered to be at the proximal-most portion containing eggs.

There is no known contrast medium that the worm will assimilate in such amounts as to allow a positive view to be taken. The lumen of the intestine is so large in ratio to the thickness of the worm that negative views may not be obtained without special arrangements.

The author used 200 cc. of astrobaryt on a fasting stomach. Two hours after ingestion the patient is fluoroscoped, placed in the sharp knee-chest position, and by compression and palpation the intestinal loops are spread. The worm was never detected fluoroscopically, but in 3 of 8 cases, negative band-like shadows about 4 mm. wide were seen, two in the terminal ileum and one in the descending colon. Roentgenograms were taken hourly from two to five hours after meal ingestion. In all 8 cases the peristalsis of the intestine was increased. Three roentgenograms are included.—*Charles Nice, M.D.*

Low, J. R., Cooper, George, Jr., and Cosby, Lewis, Jr. Meconium peritonitis. *Surgery*, Aug., 1949, *26*, 223–228.

The authors have reported a case of a four year old boy with meconium peritonitis which was diagnosed roentgenologically before operation. Since Simpson's observations published in 1838, reports of a few more than 100 cases of this disease have appeared in the literature.

Meconium peritonitis is an aseptic chemical peritonitis owing to deposits of meconium in the abdominal cavity. These may cause dense adhesions, agglutination of loops of bowel, and calcified regions. This sterile mixture of bile, epithelial cells, amniotic fluid, pancreatic, gastric and intestinal secretions escapes from the intestine through a perforation. Approximately 50 per cent of the cases are associated with intestinal obstruction. The rupture of the intestinal wall is attributed to forces resulting from peristalsis. Obstruction may be due to developmental intestinal atresia or to causes which are common in the adult, such as adhesions, volvulus and intussusception.

Meconium ileus was thought by Landsteiner to cause obstruction and perforation. The site of perforation frequently is not found at operation or necropsy. Of those cases in which there is no obstruction the site of perforation may be an ulcer of the bowel, Meckel's diverticulum, the appendix or other diverticula. In some cases no satisfactory cause for perforation is found. If the patient survives manifestations of intestinal obstruction develop.

In the authors' case symptoms and signs of intestinal obstruction developed. Roentgenologic examination of the patient disclosed gas in the stomach and in loops of the small intestine located in the left upper abdominal quadrant. Evidence of multiple gas fluid levels was demonstrated in the roentgenograms made with the patient in the upright position. Fine shadows of calcification scattered throughout the abdomen were noted. Preoperative diagnoses of intestinal obstruction proximal to the colon and meconium peritonitis were made. At operation complete atresia of a portion of the terminal ileum and agglutination of the peritoneal contents was disclosed. The bowel was repaired by a side-to-side anastomosis. At biopsy specimens from the peritoneum showed granulation tissue with infiltration by inflammatory cells, areas of fat necrosis and calcification. Follow-up examination thirty-seven weeks after operation indicated that the bowel was functioning normally. At this time a roentgenogram of the abdomen showed considerable diminution in the amount of calcium deposited in the peritoneal cavity.—*C. B. Holman, M.D.*

Harris, Milo. Place of fluoroscopy in the diagnosis of peptic ulcer. *Radiology*, June, 1949, *52*, 781–785.

In the hands of roentgenologists capable of making full use of its facilities the fluoroscope is a prime instrument in the roentgen diagnosis of diseases of the stomach and duodenum. Films for recording and checking the findings are necessary but are of secondary importance.

A properly made fluoroscope is essential and should have a screen and tube carrier that moves with little effort and shutters which obey the slightest motion of the hand in order that the manipulation of such apparatus should be very casual. A fine focal spot is essential and the screen should be as fast as possible without obvious graininess and with good contrast such as the Patterson type B-2. The contrast medium should be dense enough to obscure on the screen all bone and soft tissue detail but should fill easily. The patient should be relaxed. Dark adaptation requires not less than thirty minutes if the operator has been in bright sunlight. Palpation and manipulation

in various positions while the patient has been under observation is an important part of this examination. The screen opening should be as small as will give the maximum contrast between the barium-filled organ and the surrounding tissues.

The demonstration of a penetrating ulcer in the stomach or duodenum indicates an active ulcer; disappearance of the crater indicates that healing is taking place. This finding when seen fluoroscopically and recorded on films can be confirmed anatomically and films made by special procedures during the examination are not essential for diagnosis.—*M. M. Friedman, M.D.*

FitzGerald, Oliver, and Murphy, Philip. Studies on the physiological chemistry and clinical significance of urease and urea with special reference to the stomach. *Irish J. M. Sc.*, March, 1950, *6*, 97–159.

The enzyme urease, essential in the production of ammonia from urea, is found in high concentration in gastric mucosa, chiefly on the surface and near the oxyntic cell groups. The authors present data which they believe suggest that ammonia production from a urea substrate is an important mechanism controlling gastric acidity, that lack of urease or urea may be a factor in the pathogenesis of peptic ulcer, and that administration of urea orally in large doses is valuable in the therapy of peptic ulcer.—*H. P. Brean, M.D.*

Garcia, Manoel F., De Martini, Luiz Carlos, and Bürger, Hermann. Estômago em cascata. (Cascade stomach.) *Rev. brasil de gastroenterol.*, July-Aug., 1949, *1*, 350–360.

Among rare gastric anomalies the cascade stomach is encountered most frequently, affecting with predilection the female sex. The condition is characterized by a division of the stomach into an upper posterior segment which is usually dilated and atonic containing a large amount of air and a lower anterior segment.

Cascade stomachs are subdivided as follows: (1) those of non-pathologic origin, (a) congenital, (b) due to extrinsic pressure, (c) intra- and extra-gastric spasm, (d) aerophagy, (e) splenic flexure pressure; and (2) those of pathologic origin due to (a) ulcers, especially of the lesser curvature, (b) adhesions of the diaphragm liver, etc., (c) cicatrizations, (d) intra- and extra-gastric carcinomas and (e) gastric tetany.

The authors report 3 cases of cascade stomach and present the respective roentgenograms. In the first 2 cases, the anomaly was of congenital origin. In the third case, that of a boy eleven years of age, on roentgen examination there was a cascade stomach with a slight torsion of the fundus due to pressure from a greatly distended splenic flexure. Following treatment the gaseous distention of the splenic flexure was relieved and the anomaly of the stomach corrected itself. This case proves that the collection of an unusual amount of air plays an important role in the pathogenesis of the cascade stomach.—*T. Leucutia, M.D.*

Bosch del Marco, Luis M. Contribución al estudio de la gastritis corrosiva; estudio clínico y experimental. (Contribution to the study of corrosive gastritis; clinical and experimental study.) *An. Fac. de med. de Montevideo*, Aug.-Sept., 1949, *34*, 891–1010.

This long article represents an excellent clinical and experimental study of the chronic phase of gastritis produced by various corrosive agents.

The clinical part is based on an analysis of 9 cases: 1 personal, 4 published by Meyer and Steigmann in *Surg., Gynec. & Obst.* in 1944, three by Boikan and Singer in *Arch. Int. Med.* in 1930 and by Vinson and Harrington in *J.A.M.A.* in 1929. All cases are described in considerable detail.

The author's personal case was that of a boy twenty-two years of age who swallowed nitric acid. The disease evolved in two stages. The acute stage was characterized by hemorrhagic gastritis which was treated medically. In the chronic stage symptoms of pyloric stenosis dominated the clinical picture. A subtotal gastrectomy was performed leading to full recovery of the patient. This case is richly illustrated with roentgenograms of the stomach, photographs and a diagram of the resected gastric specimen and numerous photomicrographs from various segments of the stomach illustrating the severe corrosive changes.

A tenth case is included through the courtesy of Dr. V. A. Ugón, representing a corrosive esophagitis with stenosis which developed as a result of swallowing soda lye. After a preliminary gastrostomy a partial resection of the esophagus was performed followed subsequently by prethoracic esophagoplasty with the aid of a jejunal loop (Yudin). This patient, too, made a full recovery.

The experimental investigations comprised

the following lesions: (1) alcoholic gastritis produced with 90 per cent alcohol; (2) acute corrosive gastritis which was observed (a) immediately through an aperture in the stomach of the animal, (b) a few hours later by performing an exeresis of the viscera of the sacrificed animal, the injection of the corrosive agent into the stomach having been made through a tube the end of which was just below the cardia, and (c) the functional state of the cardia and pylorus was observed by means of gastrostomy while injecting concentrated acid and alkaline substances through a tube at various levels in the esophagus; (3) chronic corrosive gastritis, which was produced by gastric intubation and studied weeks later by means of roentgenograms of the upper gastrointestinal tract and postmortem examination.

The author used in his experiments which were performed in dogs alcohol, nitric acid, formic acid, hydrochloric acid, sulfuric acid and alkaline caustics. The pathogenesis, gross pathology, histopathology, symptomatology, roentgen appearance and therapeutic indications are dealt with in extenso. The salient points are profusely illustrated.

Of the long list of conclusions, the following are of particular interest to radiologists: The roentgen study offers valuable elements of information. After the acute stage has subsided it reveals a disturbance of the gastric motility. The maximum benefit from this examination, however, is derived in the chronic stage. The healing of the corrosive ulcerations or necrotic areas results in considerable scar formation. The retraction of the scar produces various deformities of the stomach depending on the intensity and location of the injury. The most common site of involvement is the gastric antrum leading to the roentgen syndrome of pyloric stenosis in the vast majority of the cases. A differential diagnosis from ulcer scar or malignant neoplasm as a rule encounters no difficulty. A positive history of having swallowed some corrosive agent helps, in establishing the diagnosis beyond doubt.

If the patient has survived the acute phase, the subsequent prognosis of corrosive gastritis depends on the extent of the cicatricial sequelae and the severity of the mechanical disturbances they produce. The treatment is pre-eminently surgical, consisting of subtotal resection or if the general condition is too poor, of simple gastroenterostomy.—*T. Leucutia, M.D.*

Toole, H., and Propatorides, J. Contribuição ao estudo da tuberculose gástrica. (Contribution to the study of gastric tuberculosis.) *Rev. brasil de gastroenterol.*, July-Aug., 1949, *1*, 327–340.

This article is from the Second Surgical Clinic of the University of Athens, Greece.

The authors state that gastric tuberculosis is rare and therefore the publication of any new cases is of real interest. Clagett and Waltman in 1938 were able to collect 367 cases from the medical literature. To these the authors add 10 cases which were observed in Greece since 1927.

Tuberculous infection of the stomach may occur directly through the ingestion of contaminated food, especially milk, or through the hematogenous route or by means of the lymphatics. Other sources are the extragastric invasion from the lymph nodes, transverse colon, liver, etc., and more rarely extension from the duodenum and peritoneum.

There are several classifications of gastric tuberculosis. One may mention the following: the classification of Leriche and Mouriquand into ulcerous, hypertrophic and sclerotic; that of Konjetzny into miliary, ulcerous and hypertrophic and that of Bianchi into ulcerous, hypertrophic, infiltrating inflammatory, nodular and perigastric. The authors discuss in detail the clinical significances of these various forms and the difficulty which is encountered in making a differential diagnosis from actinomycosis, syphilis, linitis plastica, hypertrophic antral gastritis and other rarer conditions.

Neither the symptomatology nor the roentgen findings are conclusive. In case of multiple ulcers or a more extensive ulceration along the lesser curvature one may suspect a tuberculous lesion. In the majority of instances, however, the appearance is that seen in peptic ulcer or carcinoma.

Of the 10 cases observed in Greece, 4 were published by Calofícon Sophronis, 4 by Gabalas, one by Christopoulos and 1 by the authors themselves. In the present article a brief résumé of the histories of all 10 cases is given.

The conclusion is reached that an accurate diagnosis cannot be made in gastric tuberculosis, except at the operation and sometimes only after a microscopic study of the specimen. In most cases the preoperative diagnosis is either ulcer or carcinoma. Since, however, gastrectomy constitutes the prevalent method of

treatment also for these lesions, as well as for some other rarer conditions which may come into consideration from the point of view of differentiation, the correct ultimate diagnosis is usually arrived at rather easily. It is important to determine whether or not a tuberculous involvement of other organs is present at the time of the operation. If for local reasons or because of the too widespread dissemination a radical resection of the stomach is contraindicated, palliative gastroenterostomy is performed to relieve pyloric stenosis and to improve the general nutritional state of the patient. Radical surgery leads to better results in the hypertrophic gastric tuberculosis than in the other forms since in the former the coexisting lesions of other organs are usually of the non-active type. On the other hand, the successful surgical treatment of the gastric localization of the tuberculosis not infrequently has a favorable effect on the clinical course of the disease as a whole. The close collaboration with a tuberculosis specialist is of great value to the surgeon.—*T. Leucutia, M.D.*

Brown, C. H., Bissonnette, R. P., and Albee R. D. Diverticula of the stomach; report of 30 cases and a review of the literature. *Gastroenterology*, Jan., 1949, *12*, 10–23.

The condition is quite rare. In 60,000 roentgenograms of the stomach, 30 cases were found. Seventy-four per cent of the diverticula reported in the literature and 90 per cent of the present series were located in the cardia. Eleven or 37 per cent, of the new cases had diverticula elsewhere in the gastrointestinal tract. The most common complication of diverticulum is hemorrhage. This occurred in 2 of the 30 cases. There is little evidence that carcinoma develops in diverticulum of the cardia. The treatment of the patient with diverticulum of the stomach is the treatment of the associated condition.—*F. J. Lust, M.D.*

Heffernon, Elmer W., Kiefer, Everett D., and Tracey, Martin L. Benign gastric ulcers occurring in the presence of achlorhydria; report of two cases. *New England J. Med.*, Oct. 20, 1949, *241*, 604–606.

Although it has been generally accepted that benign gastric ulcers do not occur in the presence of achlorhydria, a number of patients said to show this combination have been reported. However, all cases in the literature to date are open to objection as to technique of gastric analysis, lack of pathological confirmation, or discrepancy in time between gastric analysis and demonstrated ulcer activity.

The authors therefore present 2 male patients sixty-four and sixty-nine years old respectively, with surgically and pathologically verified benign ulcers of the lesser curvature, in each of whom repeated gastric analyses, with both Ewald test meal and the histamine method, showed no free hydrochloric acid and not more than 12 units of total acid, at a time when clinical examination and roentgen studies identified an active ulcer crater. One patient had the achlorhydria demonstrated on three gastric analyses, the other on eight analyses. Each patient had a characteristic history of peptic ulcer, with epigastric pain of one year or more, relieved by food or alkali. It is noteworthy that a preoperative diagnosis of gastric malignancy was made in each case because of the demonstrated achlorhydria.—*H. P. Brean, M.D.*

Wolf, Stewart. Summary of evidence relating life situation and emotional response to peptic ulcer. *Ann. Int. Med.*, Oct., 1949, *31*, 637–649.

It has been known for many years that the stomach of the subject with duodenal ulcer is a hyperfunctioning one, that is, it is red, secretes relatively large amounts of acids, is relatively hypermotile and empties in a comparatively short time. When it has been possible to induce experimental peptic ulcer in animals, the condition has been preceded and accompanied by intense engorgement of the gastric mucosa.

The authors found by direct observation of the gastric mucosa and simultaneous collections of gastric juice and recording of motility that this hyperfunctioning state could be induced by situations which engendered anxiety associated with feelings of hostility and resentment. Moreover, the stomach under these circumstances was hyperemic, turgid and engorged. When, under circumstances of sustained resentment, this pattern of gastric hyperfunction was prolonged, the pain threshold of the stomach was significantly reduced. This led to localized epigastric pain following the application of stimuli such as pinching or Faradic current, which were ordinarily non-noxious. Likewise, gastric contractions of a force and magnitude which would ordinarily not arouse sensa-

tions became painful. Thus, in the absence of ulceration but in the presence of sustained gastric hyperemia and hyperfunction, the characteristic ulcer symptoms of epigastric pain relieved by food or alkalis were frequently observed.

The pathways whereby the impulses reach the stomach which induce potentially harmful gastric hyperfunction associated with situational conflicts are unknown, but have been suspected of lying in the vagus nerves. The clinical evidence derived from the practice of vagotomy for peptic ulcer supports this view, since healing has taken place and a negligible number of ulcers have recurred following surgical procedures considered to have divided all of the parasympathetic innervation to the stomach.

Numerous attempts have been made to explain why some individuals in a setting of significant emotional conflict develop troublesome gastric hyperfunction and perhaps peptic ulcer, while others may develop precisely the opposite changes in the stomach with hypoacidity, slow emptying and nausea and still others develop other physiologic disturbances but no evidence of gastric disorder. Analysis of the conflict situation has not been fruitful, and neither have attempts to construct a constitutional or personality profile been successful in delineating very sharply between those who develop and those who do not develop peptic ulcer. It has been more profitable to examine and characterize the way in which the individual habitually met threats and challenges in his life situation. The subject with peptic ulcer may feel passive and have strong dependent needs as has been pointed out by Alexander and numerous others, but his behavior is aggressive. He must appear master of the situation in contrast to the subject with gastric hypofunction, who readily assumes a passive role in human relationships. The gastric hyperfunction itself implies a need to be fed and sustained, but is an aggressive biologic response which in animals including man precedes the act of devouring. It is thus in keeping with the general behavior of reaction competitive aggression. One probably could not answer in simple terms why a human organism elects a defensive reaction pattern of gastric hyperfunction which when sustained may be self-destructive.—*E. J. McDonald, M.D.*

FITZGIBBON, J. H. Diagnosis of lesions near the cardia. *J.A.M.A.*, Feb. 18, 1950, *142*, 453–458.

The author discusses the clinical and laboratory findings encountered in the more common lesions at or near the gastric cardia. The importance of thorough study of the visualized esophagus and stomach in the horizontal as well as the vertical position is stressed.

Congenital strictures of the esophagus usually result from congenital webs and membranes and may show longitudinal as well as annular involvement. Roentgenographic examination in the horizontal position is necessary for the demonstration of the longitudinal extent of the lesion.

Cardiospasm or achalasia results in dysphagia, regurgitation and cough. Roentgen examination should include fluoroscopic and roentgenographic studies made with the patient in the vertical and horizontal positions. Iced barium mixture will induce spasm in the mild cases. The differential diagnosis is concerned with carcinoma of the lower esophagus and fundus. The markedly dilated, elongated and tortuous esophagus with filling defects due to retained food particles is characteristic of cardiospasm.

Diffuse esophageal spasm usually is noted in the lower third and may be associated with cardiospasm, diverticula or esophagitis.

Carcinoma of the esophagus causes dysphagia of shorter duration than cardiospasm. Careful esophagoscopic examination and biopsy are of value in confirming the diagnosis. Carcinoma of the gastric fundus which does not cause dysphagia produces few early symptoms. A filling defect of the fundus is demonstrated roentgenographically. Air contrast roentgenograms with the patient upright may reveal a defect not noted when the fundus is filled with the barium mixture.

Leiomyoma of the gastric fundus may simulate carcinoma. Gastroscopic examination may be of value if the cardia is not obstructed.

The three types of hiatus hernia classified by Åkerlund are the paraesophageal, esophagogastric and that associated with a congenitally short esophagus. Gastritis, erosions or peptic ulcer may occur in any of these. In the paraesophageal variety a portion of the fundus passes into the thorax besides the esophagus without displacement of the fundus. In the esophagogastric type the cardia is involved in the hernia. Partial thoracic stomach and short esophagus are considered of congenital origin

and is not a true hernia. Clinically it may be grouped with the other types as it is believed by some that the esophagus shortens after the hernia develops.

Esophagitis, erosion or peptic ulceration of the lower esophagus may cause regurgitation, substernal distress and dysphagia. The roentgenographic appearance may resemble carcinoma.

Peptic ulcer of the stomach at or near the cardia may be associated with severe pain and dysphagia. The resulting scar may produce a defect resembling that of carcinoma.

Diverticula of the lower esophagus may cause dysphagia and substernal pain and may be associated with cardiospasm, diffuse spasm and esophagitis. True diverticula of the stomach are more frequently found near the cardia and may not always cause symptoms.

Varicosities of the lower esophagus and gastric cardia should be considered in the presence of hematemesis. Roentgen examination with a small amount of contrast material will usually demonstrate the dilated tortuous veins.

The cascade type of stomach may be noted associated with organic disease, such as carcinoma. Gastroscopic examination may reveal an ulcer or carcinoma in a cascade stomach.

Foreign bodies in the lower esophagus may cause confusion if the foreign body is nonopaque. Impaction of food in the esophagus should arouse suspicion of organis stenosis.

Eventration of the diaphragm may occur at any age. The roentgen appearance may resemble that of hiatus hernia.—*J. N. Ané, M.D.*

Paaby, Henning. Benign tumors of the stomach; case of lipoma submucosa ventriculi simulating cancer of the stomach. *Acta chir. Scandinav.*, Feb., 1949, *97*, 381–388.

Benign tumors of the stomach encountered at operation have a lower relative incidence than those encountered at routine postmortem examination. Estimates as to the latter occurrence are quoted as ranging from 15 to 25 per cent of all gastric tumors. Since many small benign tumors may be easily overlooked, the incidence is probably somewhat higher than this.

Minnes and Geschickter classify benign gastric tumors into three groups: (1) epithelial, (2) mesenchymal, (3) pseudoneoplastic. The most frequent of these tumors is the leiomyoma, of mesenchymal origin, having an incidence of 26.6 per cent. Lipomas, also of mesenchymal origin, are reported as having a frequency of 3.4 per cent. Another tumor of not infrequent occurrence is the neurinoma, which may undergo cystic and/or malignant degeneration.

The exact etiology of these tumors is, of course, unknown. The author quotes Wechselmann who claims that there is a hereditary predisposition in 50 to 60 per cent of the cases. Konjetzny says that epithelial polypi occur on the basis of a chronic gastritis, while Aschoff considers the gastritis to be secondary to the polypi. Haring noted that 10 to 14 per cent of patients with gastric polyps have pernicious anemia.

The importance of benign tumors of the stomach rests almost entirely on their ability to undergo malignant degeneration. This is especially true in regard to the epithelial tumors. This tendency towards malignant degeneration is difficult to evaluate, but has been variously estimated as occurring in 12 to 60 per cent of cases. Occult blood will be present in the stool in about 25 to 50 per cent of the cases of benign gastric neoplasms.

The author has listed a number of roentgenologic characteristics of these tumors which can be outlined as follows:

(1) They usually form a well defined filling defect surrounded by a natural relief of mucous membrane.
(2) Peristalsis is usually normal unless the tumor is ulcerated.
(3) Recesses or niches are relatively rare, and when they occur there is usually absence of convergent folds and mounded edges.
(4) The defects are most frequently situated along the wall of the stomach and do not involve the curvatures.

The author presents a case history of a white female, aged forty-seven, who had a large submucous lipoma of the gastric antrum, with ulceration and rather marked secondary anemia. —*E. C. Lasser, M.D.*

Krämer, W., and Sarre, K. Ergebnisse der Röntgenuntersuchung von 1700 Ulkusfällen in Kriegs- und Nachkriegszeit. (Findings in the roentgen examination of 1,700 ulcer cases during and after the war.) *Deutsche med. Wchnschr.*, Jan. 13, 1950, *75*, 69–71.

Changes in the relative incidence of gastric to duodenal ulcer occurred during the war years 1943–1946 with a definite increase of the former revealed by a study of 1,700 cases. Previous studies during times of peace showed an

incidence of one gastric to four duodenal ulcers. This changed to a ratio of 1:1.87, 1:0.51, and 1:0.37 of gastric to duodenal ulcer in the years 1943, 1944, and 1945 respectively. This so-called "war ulcer" was not related to caloric intake but apparently to the psychic factors incident to conflict, occurred in the older age groups with a peak in the sixth decade, was characterized by a predominance in males (3 to 1), short histories, a large crater and a relatively high position in the stomach. The "war ulcer" appears to be a fairly well defined clinical entity. A number of tables and charts accompany the article.—*L. A. Nash, M.D.*

Røjel, Kaj. On linitis plastica and on sclerosing carcinoma of the stomach (carcinoma disseminatum Krompecher; carcinoma fibrosum Konjetzny). *Acta chir. Scandinav.*, Feb., 1949, *97*, 451–469.

Brinton, in 1860, suggested the term "linitis plastica" for a condition of the stomach characterized by thickening and induration of all the layers of the stomach wall. He thought the disease was a benign sclerosis. The problem was complicated by other authors who chose to designate all sclerosing changes of the stomach, whether they be caused by ulcers, syphilis, etc., as "linitis plastica." Towards the latter part of the century, it was realized that many cases of "linitis plastica" were cases of cancer.

Benign sclerosis of nonspecific etiology may be localized to the pylorus, or may include the entire stomach. Some authors, however, maintain that general sclerosis of the stomach is always due to cancer. In any case, there is no agreement as to the etiology of benign sclerosis. It is felt that disorders which give rise to hyperemia, stasis, and edema of the gastric wall, may lead to benign sclerosis. Among these may be listed coronary and valvular heart disease, arteriosclerosis of the vessels of the stomach, emphysema, adhesive pleurisy, hepatic cirrhosis, thrombosis of the portal vein, polyserositis, chronic gastritis or phlegmon of the stomach, and chronic ulcers. As a rule, the roentgenologic diagnosis and the macroscopic diagnosis at operation will be cancer.

The diffuse, sclerosing carcinomas of the stomach display a very characteristic histopathological picture described in pioneer works by Konjetzny and Krompecher. It is characterized by a dissemination of the cancer cells and an increased formation of the connective tissue. The author prefers to use the term "carcinoma disseminatum fibrosum."

As a rule, the changes in carcinoma disseminatum fibrosum begin in the pyloric region, spread diffusely into the corpus, and finally involve the entire stomach. As in the benign form, the submocusa usually shows the greatest thickening. Local extension and metastases to the regional nodes occur frequently, but distant metastases are less common. When they do occur, the peritoneum, liver and ovaries are frequently involved.

The author reviews the literature on reported cases of unquestioned carcinoma disseminatum fibrosum. He concludes, on the basis of these, that soon after the onset of symptoms, most patients have a rapidly retrogressive course, and that it is not the rule, as Konjetzny thought, for this form of cancer to follow a rather benign course for a long time before becoming fatal.

He also reports on 14 cases of his own, collected over a twenty-five year period. He gives careful macroscopic and microscopic detail on these, and concludes by noting that the symptoms and laboratory examinations in these cases do not differ from that of cancer of the stomach in general.—*E. C. Lasser, M.D.*

Baeyer, Eric V. Diagnosis of congenital obstruction of the stomach and small intestine in the newborn. *Radiology*, Feb., 1949, *52*, 157–178.

The earliest possible recognition of and accurate preoperative information as to the location, character and severity of alimentary obstruction in the newborn is most essential. A knowledge of the clinical signs and symptoms of total, subtotal, partial and intermittent obstruction is helpful in guiding the roentgenologist in the selection of the most effective method of examination. With this in mind the author presents a table which lists the important clinical signs of partial and intermittent obstruction at varying levels in the intestinal tract. Clinically, complete obstruction usually manifests itself earlier and in a more violent and persistent manner than incomplete obstruction. The type of obstruction whether intrinsic or extrinsic cannot be determined with certainty by clinical means, although intrinsic obstruction is usually complete and extrinsic obstruction incomplete in nature.

The roentgen examination should demonstrate whether obstruction is complete or incomplete, whether intrinsic or extrinsic and the level of obstruction in the intestinal tract. To obtain this information, the author employs (1)

roentgenography without the use of contrast medium, the plain or flat film technique, (2) roentgenography with contrast medium, (3) fluoroscopy and (4) fluorography, spot-film technique. These methods are employed singly or in combination.

The value of the plain examination depends on the presence of swallowed air and its distribution in the gastrointestinal tract. Very early in obstruction there is insufficient air present to give clear-cut evidence and after obstruction has been present for a longer period, enormous dilatation of the obstructed segment of bowel may obliterate underlying details so that the level of obstruction may be obscured. In obstruction in the newborn the demonstration of fluid levels appears to be more important than the presence of gas-filled loops of intestine, and calls for examination in the erect or inverted position as well as in the recumbent. Unless unequivocal findings are present, the interpretation of the plain film is equally subject to error as the diagnosis based entirely on the clinical observations.

If correlation of the plain examination with the clinical findings does not furnish conclusive evidence, oral administration of thin barium in small amounts may be employed. Before administering barium the hazards entailed in this method of examination must be remembered and evaluated. These include regurgitation and aspiration with resultant pulmonary complications, clogging of the lumen of the distal segment after the obstruction has been relieved and most important, delay in surgical intervention. In cases of suspected complete obstruction beyond the duodenum, the use of contrast medium is not advisable. If one decides to use contrast medium, it is best administered through a soft rubber catheter. This facilitates controlled administration of the opaque material and allows removal of food and secretions and the aspiration of barium remaining in the stomach at the completion of the examination. In this type of examination fluoroscopy in association with fluorography yields the greatest amount of information.

The author reports 7 cases of congenital obstruction in the newborn in which barium studies led to the correct diagnosis of hypertrophic pyloric stenosis, pyloric spasm, duodenal atresia, malrotation with partial intestinal obstruction, aplasia of a segment of ileum, incomplete atresia of the proximal jejunum and duplication cyst of the jejunum.—*G. Lavner, M.D.*

Hicken, N. Frederick, Stevenson, Vernon L., Carlquist, John H., and Coray, Q. B. Multiple duplicative cysts of the duodenum causing acute intestinal obstruction in a girl five and one-half years of age. *Am. J. Surg.*, 1948, *76*, 92–98.

The 9 reported cases of duplicative cysts of the duodenum are tabulated and an additional case reported. In the reported case two such cysts apparently arose in the medial wall of the descending limb of the duodenum, since both cysts were encased by the serosa and muscularis of the duodenum. These cysts obstructed the duodenum by pressure and displacement of the first and second parts. One cyst was removed and the other obliterated. The patient recovered rapidly and was asymptomatic twenty-three months later.

In review of all the cases, the authors conclude that the symptoms are those of obstruction, and are not specific. Pain was not a prominent symptom, but sometimes occurred due to distention of the cyst by retained secretions or hemorrhage. When pain was present it was constant, unrelieved by vomiting. The cyst can usually be palpated when the stomach is decompressed, and size, shape and position of the mass cannot be altered by pressure, or by the decompression. Roentgen examination shows upward and outward displacement of the duodenum with resultant widening of the "U" shaped duodenal loop.—*Lois Cowan Collins, M.D.*

Chassin, J. L., and Hinton, J. W. Primary carcinoma of the duodenal bulb mimicking duodenal ulcer. *Gastroenterology*, Feb., 1949, *12*, 312–322.

The authors describe 3 cases of carcinoma of the duodenum, which clinically and roentgenologically could not be distinguished from a benign peptic ulcer. These cases were seen within thirty months, from which it might be assumed that this condition is more frequent than is generally considered.—*F. J. Lust, M.D.*

Mendl, K., and Tanner, C. H. Carcinoma of the duodenum. *Brit. J. Radiol.*, June, 1948, *21*, 309–310.

A case of this rare site of tumor involvement is reported. Carcinoma of the duodenum constitutes 1–2 per cent of all intestinal malignancies, usually arising in the region of these ampulla of Vater. These lesions may also arise from the supra-ampullary or infra-ampullary portions of the duodenum.

The tumor in the case reported was located in the second portion of the duodenum. It was treated successfully palliatively by gastrojejunostomy and cholecystoenterostomy.

Roentgenographically, a filling defect was demonstrated in the involved portion of the duodenum.—*K. L. Krabbenhoft, M.D.*

Arias Bellini, M. Volvulus of the sigmoid; a new radiologic sign. *Radiology*, Aug., 1949, *53*, 268–270.

The author states that plain roentgenograms, made in the standing and also in the supine positions, will at times permit the diagnosis of volvulus of the sigmoid without resort to a barium enemia. If the ileocecal valve is incompetent, there will be a huge arched coil with an ample connection between the two sides of the arch. On close inspection it will be evident that the two sides of the distended coil have uniform expansion and diameter. He has not seen any mention of this sign in any of the various texts. In contradistinction to this, when there is a neoplasm of the sigmoid producing obstruction, the diameter of the right side of the colon will be larger than that of the left side. This is because the cecum and ascending colon are more distensible than the descending colon.

If there is a volvulus of the sigmoid and the ileocecal valve is competent the picture is more complicated. Under these circumstances it may be possible to identify the sigmoid coil with loops of equal diameter plus distension of the remainder of the colon which is more dilated on the right than on the left.

Should a barium enema be administered it may be arrested at the rectosigmoid region and form what is known as a "snake's head" or it may pass the point of obstruction even though the coil has turned on itself as much as 360 degrees. In this latter case the barium cannot be expelled.—*A. E. Childe, M.D.*

Gross, Robert J. Cauda equina syndrome due to silent rectal carcinoma. *Radiology*, Aug., 1949, *53*, 271–273.

Gross reports the case of a male, aged forty-three, with chief complaints of pain and lump in the right gluteal region. There were no rectal symptoms. Rectal palpation revealed a posterior mass but no irregularity of the mucosa. The clinical impression was cauda equina syndrome, etiology unknown.

Roentgen examination revealed an osteolytic lesion of the right half of the sacrum. At biopsy pus and necrotic tissue were evacuated and the cavity packed with iodoform gauze. Microscopic study showed necrotic bone infiltrated by epithelium suggesting tumor primary in the gastrointestinal tract. Barium enema revealed anterior displacement of the rectum, no irregularity of the rectal wall, and no communication with the gauze-filled tumor cavity.

At postmortem a flat tumor was found on the posterior wall of the rectum, 3 cm. from the sphincter, 3 cm. in diameter. There was no extension into the perirectal tissues and no direct continuity between the rectal lesion and the sacral mass. Microscopic study showed cellular formation similar to that found in the original biopsy.—*A. A. Brewer, M.D.*

Buzzi, Germano. Sindromi occlusive da diverticolo-sigmoidite. (Symptoms of obstruction from sigmoid diverticulitis.) *Ann. radiol. diag.*, 1949, *21*, 323–334.

The author describes 3 cases of acute intestinal obstruction as a result of diverticulitis of the sigmoid. The advantages of roentgen examinations by means of barium enema are listed. The differential diagnosis in such cases should include ulcerative colitis, malignant neoplasms, tuberculosis, syphilis, blennorrhea, lymphogranuloma inguinale and mycotic infections.

The roentgen diagnosis made in such cases may prevent surgical intervention as the treatment is medical. The symptoms of obstruction and inflammation subside after a few days of treatment.—*P. E. Russo, M.D.*

Shull, J., Schulz, M. D., and Jones, C. M. Roentgen examination of the defunctioned colon after ileostomy, with special reference to the safety and practical value of thorium dioxide as a contrast medium. *Gastroenterology*, Jan., 1949, *12*, 1–9.

Periodic roentgen examination of the defunctioned colon in the patient with ulcerative colitis is indicated. The use of barium sulphate may be attended with occasional undesirable effects, probably because of the accumulation of unexpelled barium in the colon. Thorium dioxide solution as a substitute opaque medium for roentgen examination gives excellent contrast and relief of the defunctioned colon. It is easily expelled, though perhaps no more so than is barium sulphate suspension, and a minimum of solid residue remains from any small amount

that is not expelled. It is, however, a mildly radioactive substance. Untoward effects following the use of thorium dioxide, as the contrast medium in examination were not completely absent, being present with no less frequency than with the use of barium. It is concluded, on the basis of these observations, that thorium dioxide offers a technically satisfactory additional means of examining the defunctioned large bowel, but that the routine used need not be encouraged.—*F. J. Lust, M.D.*

Daniel, William H. Obstructive lesions of the descending colon and rectum. *J.A.M.A.*, Dec. 10, 1949, *141*, 1035–1036.

Obstructive lesions of the descending colon and rectum progress slowly with gradually increasing colicky pain, change in bowel habits, and occasionally develop acute obstruction.

Malignancy of the descending colon may show dark blood or blood streaked stools. Frequency of evacuation is common and simulates dysentery. Late lesions, both malignant and inflammatory may first be manifested by involvement of the bladder or vagina.

Diagnosis requires rectal digital examination, sigmoidoscopy, biopsy, if indicated, barium enema and, in undiagnosed cases, surgical exploration. Barium enema is reserved for those lesions beyond the reach of the sigmoidoscope. A stenotic malignancy is sharply defined, short in length and usually lacks mucosal markings. The defect in diverticulitis is longer, more fusiform and diverticula are commonly seen. Endometriosis shows a normal mucosa. Polypoid lesions are best seen with air contrast enemas.

Treatment depends upon the lesion.

Carcinoma is preferably treated by resection with anastomosis. In the rectum, abdominoperineal resection or colostomy and perineal resection are preferred.

Inflammatory lesions including diverticulitis, ulcerative colitis, lymphogranuloma inguinale, and post-irradiation fibrosis may require colostomy or even more extensive surgery if conservative therapy is inadequate.

Endometriosis may require resection. Castration by surgery or irradiation is an alternative.

Polyps should be resected.

Acute obstruction as from volvulus requires emergency treatment.—*C. Colangelo, M.D.*

Steiner, C. A., and Palmer, L. H. Angiosarcoma of the colon with case report. *Ann. Surg.*, April, 1949, *129*, 538–542.

The primary lesion was treated by a segmental resection of sigmoid colon and the patient was clinically well for six months. At that time metrorrhagia led to a gynecological examination and the discovery of a large polypoid growth extending from the cervical os. Pathologically, this lesion was similar to the primary lesion of colon. The patient was treated by 3,600 mg. hr. of radium in the cervical canal and this was followed by a pelvic series of external and transvaginal irradiation. One year later the patient was symptom free and there was no evidence of persistent disease on examination.—*V. P. Collins, M.D.*

Scarborough, Robert A., and Klein, Russell R. Polypoid lesions of the colon and rectum. *Am. J. Surg.*, 1948, *76*, 723–727.

The authors report on 458 examples of presumably benign polypoid lesions of the colon and rectum occurring in a review of 10,000 patients.

Fibromas, myomas, endometriomas, hemangiomas, granulomas and lymphomas accounted for 5 per cent of the polypoid lesions encountered. These were classified as not premalignant.

The remaining 95 per cent of polypoid lesions were classified as pre-malignant. These included inflammatory hyperplasia, hyperplasia, adenomas and papillary adenomas. The papillary adenomas should be studied with particular care. There were 60 such lesions and in 18 of these, malignant degeneration was encountered on careful study. Two of these patients were inoperable at laparotomy because of metastases, 3 subsequently died of distant metastases, and 2 showed metastases to regional lymph nodes on examination of the surgically resected specimen. It is recommended that, following the removal of a polyp, or the resection of a carcinoma, periodic sigmoidoscopic examination should be done and roentgen studies should be repeated as often as necessary. —*V. P. Collins, M.D.*

Marshak, Richard H., and Henkin, William. Cholecystocolic fistula. *Radiology*, Oct., 1949, *53*, 555–558.

Cholecystocolic fistula is an infrequent complication of gallbladder disease. It occurs usually as a result of cholelithiasis with adhesions and subsequent perforation through the wall of the colon. The preoperative diagnosis is seldom made and when made has usually

been determined from a barium enema examination. Two such cases are described, both of which showed some air in the biliary system on scout films and demonstration of the fistulous communication between the gallbladder and colon by barium enema examination. No complicating cholangistis resulted from the barium enema. One of these cases had surgical correction; the other did not, but had recovery from symptoms nevertheless.—*P. R. Dirkse, M.D.*

Smith, Marcus J., and Moore, George E. Sodium tetraiodophthalicfluorescein for intravenous cholecystography. *Radiology*, Oct., 1949, *53*, 552–554.

This new drug was used for intravenous cholecystography in 25 patients. The suggested dosage is 40 mg. per kilogram of body weight. The average adult dose has been 2 to 3 gm., made up in a 10 per cent solution in distilled water. The optimum gallbladder concentration is at two to three hours after injection. Toxic reactions have been slight. However, all patients' skins have been tinted a light flesh pink color for twelve to eighteen hours. Some of these cases were also studied by the oral cholecystographic method.

Results to date are promising and justify further investigation.—*P. R. Dirkse, M.D.*

Hicken, N. F., Stevenson, V. L., Allen, L. M., and Cornwall, C. R. Double gall bladders; report of four cases, one with suppurative cholangitis and bacteremia. *Surgery*, March, 1949, *25*, 431–440.

The authors report 4 cases of complete duplication of the gallbladder. In this condition the two gallbladders were separate and distinct, and each was drained by its own cystic duct. While the manner in which the cystic ducts unite with the common duct can and does vary, double gallbladders must not be confused with the "bilobed" or "bifid" varieties. Double gallbladders are usually not contiguous.

In the first case a woman, forty years of age, had a persistent external biliary fistula after cholecystectomy was performed, at which time no anatomic abnormality was recognized. Cholangiograms taken at regular intervals showed evidence of an accessory gallbladder with stones in the common hepatic bile duct and in the gallbladder itself. These observations were confirmed by subsequent operation. The cystic duct of the accessory gallbladder united with a common duct above and posterior to the junction of the common duct and the cystic duct of the gallbladder which had been removed previously.

In the second case a physician, fifty years of age, had undergone cholecystectomy for relief of "biliary colic." What was thought to be a tumor closely associated with the main distended gallbladder proved to be an accessory gallbladder which had no communication with its mate. The separate cystic ducts which measured 2 cm. in length united to form a common cystic duct which was 1.5 cm. in length.

The third case is that of a patient fifty-one years of age. Cholecystograms revealed two separate gallbladders filled with contrast medium. The shadows showed evidence of contraction of these organs after the patient had eaten a fatty meal. Operation was refused, and the diagnosis could not be confirmed.

The fourth case was that of a physician forty-two years of age. Cholecystograms revealed evidence of two gallbladders filled with opaque medium. There was no change in shape or density after the patient's ingestion of a fatty meal and gallstones could not be detected. This patient also refused operation.

Forty-eight cases of double gallbladder which have been recognized by routine roentgenograms have been reported previously. In 95 per cent of these there was evidence of function of both gallbladders. There is no characteristic syndrome to indicate the presence of a double gallbladder. It is suggested that only one of the paired organs may be diseased so that a radiologist's report of a normally functioning gallbladder may deter exploration even though a diseased gallbladder may be present. Since other congenital anomalies may simulate this condition on cholecystographic studies, roentgenograms with the patient in several positions should be made. These anomalies can be recognized by cholecystographic studies made while the patient is on the operating table. The medium is injected into the presenting gallbladder and the other extrabiliary segments are allowed to fill. This procedure would have been of benefit in the first case.—*C. B. Holman, M.D.*

Domzalski, Casimir A., Jr. Calcareous pancreatitis. *Ann. Int. Med.*, Oct., 1949, *31*, 650–660.

Two cases of diffuse pancreatic calcification are reported because of their relative rarity and because several striking clinical features were

common to both cases. The outstanding clinical features were: (1) steatorrhea with marked weight loss, (2) severe, and in one case intractable, diabetes, and (3) complicating pulmonary tuberculosis. It has been generally observed that steatorrhea occurs in only about one-half of all cases of calcareous pancreatitis. It was a prominent feature in both cases reported, although only the first patient actually complained of diarrhea. Pancreatic insufficiency could reasonably be expected from the relatively marked destruction of glandular tissue that was shown by the roentgen ray, although disturbances of pancreatic function have been absent in about 10 per cent of the reported cases of pancreatic calcification.

Diabetes mellitus, latent or active, is said to occur in about 50 per cent of all cases of pancreatic calcification. This is a much higher incidence of diabetes than occurs when pancreatic damage is due to obstruction of the ducts by a pancreatic calculus. It is well known that when stones obstruct the pancreatic ducts, destruction of the acinar tissue is early, rapid, and quite complete, but the islands of Langerhans survive until very late in the process.

The diabetes may appear even before calcareous pancreatitis develops. This occurred in 2 of Pasternack's cases and in both of these cases. This is not at all difficult to understand when the two underlying pathological processes are separately analyzed. Ductal stones destroy acinar tissue by simple back pressure and retrograde inflammation secondary to stasis. In contrast, diffuse parenchymal calcification occurs first in the interstitial tissue. This tissue is involved in both acute hemorrhagic pancreatitis, and in acute interstitial pancreatitis.

Complicating biliary disease is reported to be fairly common in almost all forms of pancreatic disease. A normal cholecystogram was obtained in the first case, and although abnormal function was reported in the second case, no structural abnormality was discovered at autopsy. Degenerative fatty infiltration of the liver producing a palpably enlarged liver occurs in some cases of chronic pancreatitis, the "pancreatohepatic syndrome," most probably due to a deficiency in lipocaic, the pancreatic hormone which regulates the deposition of fat in the liver cells.

Patients with calcifying disease of the pancreas are predisposed to pulmonary complications, and both of these cases developed pulmonary tuberculosis. Two of Pasternack's cases and one of Snell and Comfort's also had pulmonary tuberculosis. Other pulmonary complications, such as bronchopneumonia, abscess, and gangrene have been reported. It is interesting to speculate as to whether or not the metaplasia of the bronchial epithelium resulting in these patients from the loss of vitamin A in the fatty stools is an important factor in predisposing them to pulmonary infections.—*E. J. McDonald, M.D.*

GYNECOLOGY AND OBSTETRICS

Hodges, Paul C., and Nichols, Russell L. Orthographic pelvimetry. *Radiology*, Aug., 1949, *53*, 238–247.

Orthographic pelvimetry is the production of true dimensional tracings of the frontal and lateral views of the pelvis on which one can take the numerous measurements required for obstetrical purposes without the aid of computations or specially calibrated rulers.

The 90 degree apparatus used in making the frontal and lateral films of the pelvis is described and illustrated. Basically, this unit consists of a Potter-Bucky grid and a roentgen tube mounted together on a cradle that can be rotated to take both frontal and lateral films of the pelvis without moving the patient. The grid is provided with a phototimer which further facilitates the examination.

The linkage pantograph is next illustrated and described. This apparatus makes it possible to produce orthographic tracings from the films with reduction in size of the tracings to correct for divergent distortion in the films. Oblique distortion on the films is also corrected on the orthograms. The geometry of the pantograph and the production of the orthograms is precise. The main source of inaccuracy is in identifying the parts on the roentgenograms.

The special equipment necessary makes this type of examination not suited to any but departments where the volume of work is very large.—*R. E. Kinzer, M.D.*

Reid, F. The radiological localisation of the placental site. I. Normal implantation. *Brit. J. Radiol.*, Oct., 1949, *22*, 557–566.

Previously the placenta has been demonstrated by intravenous placentography and aminography. No satisfactory medium has been found for the first; the second has been more or less abandoned, but it has much in its favor, particularly where the usual methods fail.

Soft tissue roentgenography is the almost universally employed method for demonstration of the placenta. The outline of the fetus is shown by the low density of the subcutaneous fat. Outside this is a uniformly dense shadow consisting of the liquor amnii, the placenta, and the uterine musculature. As the fetal specific gravity is slightly greater than that of the amniotic fluid, it is usually dependent. The placenta is implanted on the anterior or posterior uterine wall in at least 95 per cent of cases. Thus, if the amniotic fluid is symmetrical, the difference between the thickness of tissue anterior and posterior to the fetus frequently represents the thickness of the placenta. The placenta is to be thought of as a saucer-shaped organ on the uterine wall, containing amniotic fluid. The fetus may displace some of this fluid, but does not produce a pressure defect in the placenta itself, which is usually not more than 3 or 4 cm. in thickness. If the patient is examined by roentgenograms made in a lateral projection with the patient alternately supine and prone, a definite localization can be obtained in most instances. Errors can arise at times because of the frequent obliquity of the uterus, asymmetry of the placental vascular supply, variations in placental dimensions, and excess of liquor amnii.—*E. F. Lang, M.D.*

HARTLEY, J. BLAIR. Detection of foetal abnormalities. *Proc. Roy. Soc. Med.*, London, May, 1949, *42*, 301–310.

A technique for fetal examination is presented. Roentgenographic technical factors, such as proper positioning of patient and the use of a compression band, and exposure factors are given in detail.

Before the fifth month the anteroposterior view is the valuable one in detecting pregnancy and minor abnormalities. To obtain the anteroposterior or lateral views of the fetus, oblique views of the mother are often necessary.

The examination should provide identification of fetal parts, their relationship to the maternal uterus and pelvis, an estimation of maturity, and any other features which might prove significant in the conduct of the labor.

The fetal head should be examined for its size and development in relation to that of the skeleton, outline of the vault and the precise outline of the bones of the skull. Any interruption of contour or slightest reduplication of the fine, smooth, curved single line normally seen delineating the skull vault should be regarded with utmost suspicion.

Craniostenosis can be roentgenologically demonstrated before term, and if present a search should be made for craniolacunia. The fetus which has an occipital encephalocele tends to show a dolichocephalic outline. Abnormal fetal posture should arouse suspicion as to the possibility of anomalous fetal development.

The fetal spine should be examined for normal smooth curvature, and each area examined for defective or deformed vertebrae. Spina bifida is the commonest anomaly and the easiest to detect. Rib deformities are frequently associated with spinal deformities, and may be detected first.

The detection of hydramnios will warn the radiologist to look with special care for fetal abnormalities.

When a fetus becomes distressed it becomes rolled up into a ball-shape. If this Ball sign can be demonstrated roentgenologically to become progressively more pronounced it is an indication that fetal death is occurring. Spaulding's sign may occur anywhere from sixty-three hours to six to seven days after clinical evidence of fetal death. But even in the presence of Ball and Spaulding's signs the fetus may be dead in only 90 per cent of the cases.

Minor skeletal defects may escape detection, and most soft tissue defects usually do.

Roentgen examination is the only method by which the progress of osseous anomalies can be adequately studied in those fetuses which survive.—*D. R. Bernhardt, M.D.*

NEIBURGS, H. E., and PUND, EDGAR R. Detection of cancer of the cervix uteri; evaluation of comparative exfoliative cytologic diagnosis: a study of 10,000 cases. *J.A.M.A.*, Jan. 28, 1950, *142*, 221–226.

The authors examined 10,000 women by smears obtained from the cervical canal and posterior fornix, and checked positive findings by biopsy. Smears were classified as 1, 2, 3, 4 and 5 according to the method of Papanicolaou, 1 and 2 being negative, 4 and 5 positive. Class 3 is usually considered equivocal and the authors deliberately attempted to place as few as possible in this class. However, a large number of confirmed cancers were found in this class 3 group, hence they regarded it as positive, along with 4 and 5, and when class 3 smears were followed by a negative biopsy, the finding was

classified as false positive. Biopsies were classified as borderline, preinvasive carcinoma, covert invasive carcinoma and overt invasive carcinoma.

Of the 10,000 patients, 332 (3.3 per cent) showed positive cytology, and 234 were examined by biopsy; 185 biopsies were positive for carcinoma (68 borderline), 49 were false positives and 5 were false negatives. The false negatives comprised 2 cases of endometrial cancer, 2 cases of preinvasive squamous carcinoma of the cervix and 1 case of invasive carcinoma of the cervix. In the group of class 3 smears, cancer was found in 56 per cent, 4 per cent were borderline and 40 per cent were false positives. Classes 4 and 5 gave 85 per cent proved cancer, 3 per cent borderline and 12 per cent false positive. However, negative biopsies in the presence of positive smears have been temporarily classified as false positive since the biopsy was inadequate in a number of cases and further studies are necessary to determine the status.

They found that 42 per cent of patients with proved cancer were asymptomatic for cancer.

They consider that one negative biopsy with positive cytology is insufficient evidence to rule out cancer and only one negative smear should not be regarded as proof of absence of carcinoma. In their opinion the study of exfoliative cells should not be considered a complete diagnostic procedure, and no one should attempt cytologic diagnosis unless he has had at least one year of experience with sufficient material. Emphasis is placed on the recognition of preinvasive cancer from smears, since it is in this type that biopsy is apt to be negative, and yet, in their series, 40 per cent of the detected cancers were preinvasive. Knowledge of the cells shed from the preinvasive cancer prevents negative classification and necessitates further biopsy until the cancerous area is located, if necessary by curettement.

They place the cost of detecting a single case of preinvasive cancer at between $120.00–$150.00, but the unit cost is diminished when invasive cases are included.—*A. K. Wilson, M.D.*

Odell, Lester D., and Burt, James C. New diagnostic adjunct for uterine cancer. *J.A.M.A.*, Jan. 28, 1950, *142*, 226–230.

The authors were stimulated in the investigation they report by figures, which they quote, indicating (*a*) that only about 20 per cent of cervical carcinomas reach the gynecologist in an early stage, (*b*) Papanicolaou smear technique, used as a screen for uterine cancer, yields 30 per cent false negative results, (*c*) smear techniques require special training, and (*d*) there are not enough trained cytologists. "Every physician would welcome a simple chemical test which could be used with confidence."

With reference to enzymes, they quote J. P. Greenstein (Biochemistry of Cancer, Academic Press, Inc., New York, 1947) "each normal tissue is characterized by the presence of an individual pattern of enzymic activity which may distinguish it from all other tissues—tumors have qualitatively the same enzymes as normal tissues." Cancer tissues, however, may exhibit quantitative differences, and these differences may vary from tissue to tissue.

Beta glucuronidase was selected because its activity has been closely related, through a series of experiments, to glucuronic acid metabolism, estrogen metabolism, growth of the endometrium, normal pregnancy and toxemia of pregnancy. With respect to cancer, greater glucuronidase activity has been noted in mammary cancer and involved lymph nodes, and in gastric, intestinal and metastatic cancers than in normal uninvolved tissues. Furthermore, beta glucuronidase is quantitatively altered to a significant degree and the test reaction is simple enough for average technical facilities.

The method depends upon incubation of tissue or fluid to be tested with a substrate, which is phenolphthalein glucuronide, obtained from the urine of rabbits to which phenolphthalein diphosphate was administered. In the incubation process, the phenolphthalein radical is liberated. If this solution is adjusted to an alkaline hydrogen ion concentration, a red color results and the intensity of this color is compared with known amounts of phenolphthalein. The activity of beta glucuronidase is expressed as micrograms of phenolphthalein liberated per gram or cubic centimeter of tissue or fluid per hour of incubation. They selected 300 micrograms of phenolphthalein liberated per cubic centimeter of fluid per hour of incubation as a practical division between positive and negative—positive results were above 300, negative (benign) results below that figure.

In a series of 292 cases studied, they found 18 per cent false positive results; these occurred predominantly in pregnancy, during men-

struation and in women with vaginitis. No false negative results were reported. It appears, thus, that the margin of error is on the "safe" side and is no greater than that found in any but the most expert hands with vaginal smears.

The authors admit that their series is small and they are desirous that the study be extended to some of the larger clinics in the country. To facilitate this, they offer to supply some of the substrate, which is difficult to make, to some physicians, in order that they may have help in accumulating data.—*A. K. Wilson, M.D.*

Hirst, John C. Carcinoma of the uterine cervix complicating pregnancy. *J.A.M.A.*, Jan. 28, 1950, *142*, 230–236.

The author notes, by way of introduction, that according to reports of the last five years, there has been little effort to detect early cancer of the cervix during pregnancy, and that such neglect is remarkable because of the availability to all physicians of the diagnostic smear and because of the status of carcinoma in situ, or intraepithelial preinvasive cancer, which particularly concerns pregnancy. Only approximate figures are available, but it would appear that the incidence of cancer in women of reproductive age is 0.02 per cent and the incidence of pregnancy in cancer of the cervix is 0.34 per cent. In a series of 2,264 patients in the child-bearing age, the author found an incidence of cancer of 0.09 per cent.

For several years the author and his associates have inspected the cervix of each newly registered pregnant woman in the ward service of the Preston Maternity Hospital, Philadelphia, and from biposy have discovered 1 cancer in 2,042 cases. They recently commenced a study consisting of routine smear made by spatula from the cervix, checked by biopsy where smear is positive or suspicious, in all patients admitted to that hospital and in one-half of the patients admitted to the maternity ward service of the Philadelphia General Hospital. In the latter institution, one cancer has been found in 222 admissions.

Biopsy technique consists of utilization of a small Schubert punch, dusting the part well with sulphonamide powder and hemostasis by pressure of cotton balls. They have had only one case of excessive immediate bleeding; there have been no cases of delayed hemorrhage, subsequent infection or interruption of pregnancy.

The author discusses in detail the management of cervical cancer in pregnancy, and draws attention to the fact that there is no unanimity of opinion. From the literature, methods advised consist of various combinations of caesarean section, hysterectomy, Wertheim operation and irradiation, by either radium or roentgen ray or these in combination.

Five cases from Philadelphia Lying-In Hospital are summarized.

The author advises inspection of the cervix twice during pregnancy and for symptoms of threatened abortion of more than one to two weeks' duration. He considers the Papanicolaou cervical smears reliable for screening purposes during pregnancy. "Cervical punch biopsy is safe and reliable during pregnancy, with due regard to histologic changes incident to pregnancy." "Delay in diagnosis and treatment is common in pregnant women."—*A. K. Wilson, M.D.*

GENITOURINARY SYSTEM

Wilhelmi, O. J. Hydrocalycosis. *J. Urol.*, Aug., 1949, *62*, 206–210.

The author reviews the literature relative to dilatation of a single calyx of a kidney. The condition is usually secondary to obstruction. It may also result from achalasia at the neck of the calyx. The condition must be distinguished from true cysts and diverticula. The former should have no connecting channel with the renal pelvis, and should not visualize with retrograde pyelography. The condition is usually associated with some degree of renal pain. The treatment of choice has been nephrectomy.

The author reports a single case which is the first report of a case of hydrocalycosis involving a minor calyx of the middle major calyx. The author apparently does not distinguish between a true hydro calyx and a cyst due to failure of union of the collecting tubule and the glomeruli. —*R. M. Harvey, M.D.*

Gahagan, H. Q., and Reed, W. K. Squamous cell carcinoma of the renal pelvis; three case reports and review of the literature. *J. Urol.*, Aug., 1949, *62*, 139–151.

The authors have reviewed the literature and found 106 reported cases of squamous cell carcinoma of the renal pelvis. They add 3 cases of their own. The cases reported in the literature are tabulated according to sex, age, preoperative diagnosis, type of operation, patho-

logical diagnosis and end results. According to the authors the correct preoperative diagnosis has never been made. Almost 50 per cent of the cases were associated with calculi. Infection was present in a high percentage of cases. The prognosis is poor, no five year cures having been reported.—*R. M. Harvey, M.D.*

Batalla Sabaté, Luis. Utilidad de la pielografía retrógrada en el diagnóstico de los cálculos del uréter. (On the usefulness of retrograde pyelography in the diagnosis of calculi retained in the ureter.) *Arch. españ. urol.*, April, 1949, *5*, 298–307.

The usefulness of flat roentgenograms and intravenous pyelography is discussed. The author insists on the usefulness of retrograde pyelography in certain instances. He illustrates his opinion with a case of double ureter with a calculus retained in one of them. Since the shadow of the calculus did not correspond to the position of one of the ureters, the diagnosis was not made until the retrograde pyelography revealed the anatomical anomaly.—*J. A. del Regato, M.D.*

McCrea, L. E. Cutaneous metastasis of bladder carcinoma. *J. Urol.*, Aug., 1949, *62*, 158–162.

Cutaneous metastases from bladder carcioma are usually associated with metastases to other sites. Bladder carcinoma metastasizes slowly and only uncommonly to the skin. The author could find only eight references in the literature to cutaneous metastases from bladder carcinoma. The lesion may appear as a discrete painful nodule or multiple painful nodules resembling small lipoma. They are not attached to the skin and do not alter the appearance of the skin.

A second type of skin metastasis consists of an open ulcerated lesion with indurated margins. The author reports 2 cases in detail.—*R. M. Harvey, M.D.*

Kretschmer, Herman, L., and Stika, Edward A. Papilloma of the bladder; life after fulguration. *J.A.M.A.*, Dec. 10, 1949, *141*, 1039–1041.

The authors present a study of 100 unselected cases followed a minimum of five years in which the diagnosis of benign papilloma of the urinary bladder was made at the time of the first cystoscopic examination. The object of the study was to determine the accuracy of diagnosis at the first cystoscopy, duration of life after the initial diagnosis and treatment by fulguration, and thereby answer the question, "how potentially malignant is the so-called benign papilloma of the bladder with present day methods of fulguration?"

The largest number of cases in the present series occurred in the sixth decade with a preponderance of males over females in a ratio of 4:1. There was no occupational incidence. Hematuria was the presenting symptom in 87 (87 per cent) of the cases. Forty-five per cent of the cases had single tumors and 55 per cent had multiple tumors. It was in this latter group that carcinoma eventually developed.

The initial cystoscopic examination was wrong in 3 cases (3 per cent) and subsequent examination revealed a malignant tumor. In 10 patients (10 per cent) carcinoma of the bladder eventually developed, confirmed by cystoscopic and microscopic examination. These malignant tumors developed within a period of two to eighteen years and in an average of eight years. Five patients died of cancer of the bladder after living twelve to fourteen years.

Fifty-three of the patients were alive and well, the duration of life after the initial fulguration varying from five to twenty-eight years. The average duration of life in this group was 16.4 years. Thirty-four of the patients died and in this group the average duration of life was 12.7 years, and aside from one patient whose death was attributed to nephritis, none of these deaths was due to genitourinary disease. The authors think that the incidence of tumor growths in other organs after the patient was treated for a papilloma of the bladder may signify a "tumor prone" type of person, as primary tumors developed in 12.6 per cent of the patients in other organs after the onset of their bladder tumors.

Not all papillomas of the bladder are necessarily malignant and great care must be exercised in designation of tumors by the terms malignant or potentially malignant.—*W. H. Smith, M.D.*

Ritter, J. Sidney, and Shifrin, Leo A. Cancer of the female urinary bladder. *J.A.M.A.*, Dec. 10, 1949, *141*, 1042–1045.

The authors point out the necessity of complete urologic investigation of microscopic or macroscopic hematuria, dysuria, and urinary frequency if early diagnosis and cures of bladder tumors are to be realized.

They describe the procedures in the complete work-up of a patient with suspected bladder pathology and illustrate diagrammatically the types of lesions seen. According to clinical classification, the small pedicle growth should be considered benign. As the base of the growth becomes larger and the tumor more sessile, the degree of malignancy is greater. The small benign types of growth will respond to simple endoscopic excision and electrocoagulation of the base. For the malignant infiltrating growth involving the trigone, radical cystectomy with uretero-intestinal or ureterocutaneous implantation is advisable. For those growths in resectable areas of the bladder, partial cystectomy, with or without ureteral reimplantation into the bladder, is employed and advocated with expected good results.

For large or multiple tumors of relatively benign nature, the authors describe and illustrate their surgical procedure. This consists of dilatation of the urethra and removal of the tumor. They point out that this method permits bimanual palpation of the tumor and thus better evaluation of its infiltration and malignancy. Palpation after removal permits evaluation as to the completeness of surgery. The postoperative course has been short and uncomplicated and all the authors' patients have had complete urinary control. Three cases that illustrate the value of this technique are presented.

The authors think that making these patients happy and comfortable is important and that the procedure they advocate is a long step forward in that the patient is more willing to enter the hospital, the procedure is simple, removal of the growth is complete, and convalescence is rapid.—*W. H. Smith, M.D.*

Stirling, W. Calhoun, and Ash, J. E. Tumors of the bladder. *J.A.M.A.*, Dec. 10, 1949, *141*, 1036–1039.

This article is based upon a series of 105 cases of bladder tumor, of which 100 were primary in the bladder. The preponderance of males beyond the sixth decade was notable. The chief symptoms were hematuria and dysuria. Death from bladder tumor is usually caused by infection of the genitourinary tract secondary to obstruction.

The treatment and prognosis are influenced by the invasiveness and the location of the tumor. Tumors above the trigone can be resected in toto and have the best prognosis. Unfortunately, 75 per cent of all bladder tumors are located in the trigonal area and must be treated by fulguration, transurethral resection, interstitial radiotherapy or cystectomy, which is as yet in the problematic stage. Interstitial radiotherapy was used three weeks after surgery when resection was believed to be incomplete; 1.5 millicurie radon seeds were imbedded 1 cm. apart throughout the tumor area. The authors also mention Barringer's results with interstitial radon seeds as the sole means of therapy in which he obtained 55 per cent five year cures in Grade 1 tumors, 32 per cent five year cures in Grade 2 tumors, and 11 per cent five year cures in Grade 3 tumors.

The table of results showed 60 per cent of the patients living at the time of this report, but the length of survival was not given. Most of these patients had had surgery of some type.—*C. Colangelo, M.D.*

Myhre, J., and Flink, E. B. Myelofibrosis and generalized osteosclerosis secondary to carcinoma of the prostate. *J. Urol.*, Aug., 1949. *62*, 178–184.

The authors report the case of a fifty-six year old male with carcinoma of the prostate who had no evidence of metastases to the bones when first studied. He did have a marked elevation of the alkaline phosphatase, and a typical leuko-erythroblastosis with severe anemia due to myelofibrosis secondary to metastasis. The bones, which had originally been negative to roentgen ray, later developed a diffuse osteosclerosis. The patient had a low calcium excretion. The high level of alkaline phosphatase indicated increased osteoblastic activity and accounted for the increased deposition of calcium in the bones and the lowered calcium excretion in the urine. The estrogens which were given the patient may have played some part in the osteosclerosis. Only a few cases of myelofibrosis secondary to metastatic prostatic malignancy have been reported.—*R. M. Harvey, M.D.*

Waller, J. I., and Shullenberger, W. A. Lymphosarcoma of the prostate. *J. Urol.*, Oct., 1949, *62*, 480–487.

The author reviews the literature regarding lymphosarcoma of the prostate and adds a case of his own. His patient was a sixty-eight year old Negro who had had insidious onset of weakness, loss of appetite, and uncertainty of body movements. He had some difficulty in starting

urination. A suprapubic mass became palpable three months after admission, which was thought to be due to a distended urinary bladder. Only a small quantity of urine could be obtained by catheterization and subsequent examination disclosed a tumor of the prostate. The patient died and autopsy disclosed a mass between the bladder and rectum which had destroyed the prostate and seminal vesicles. Histopathologically the tumor was a lymphosarcoma.

The average age of patients with lymphosarcoma of the prostate is forty-one years. The symptoms of the disease are those of vesical neck obstruction. Rectally the lesion feels like a prostatic abscess. The cystogram may reveal displacement of the bladder. Pain is due to pressure on the sacral nerves. Treatment by some form of irradiation is indicated. The prognosis is poor.—*R. M. Harvey, M.D.*

Campbell, M. F. Stricture of the urethra in children. *J. Pediat.*, Aug., 1949, *35*, 169–179.

Twenty per cent of the cases of urologic disturbances in children seen by Campbell suffered from congenital urethral strictures as the fundamental lesion or as an important coexisting one. Congenital strictures of the urethra are similar to similar narrowings found in the ureters, biliary ducts and gastrointestinal tract. The important consideration is the effect of the subsequent obstruction on the upper urinary tract. Proximal dilatation of the urethra follows and then dilatation and trabeculation of the urinary bladder. Eventually the ureterovesical mechanism fails and progressive enlargement and elongation of the ureters results. The final result is hydronephrosis with the kidney becoming eventually a hollow shell. Death occurs from uremia or urinary infection.

The symptoms of urethral stricture are those of obstruction with dysuria, frequency, dribbling, etc. When advanced renal injury has resulted from chronic back pressure the symptoms of urinary toxemia occur. Ulcerative meatitis is a frequent complication.

The diagnosis of stricture of the external urethral meatus can be made readily in boys by observing the pinpoint external meatus. Deeper strictures are diagnosed by passage of sounds. In the female the diagnosis is made by the difficulty in passage of small sounds which are grasped by the stricture. Confirmation of the diagnosis can be made by the urethroscope.

The author discusses the treatment, which is largely surgical, at some length.

Acquired urethral strictures, which are almost always of gonorrheal origin, are also discussed. Traumatic strictures are most often the result of instrumentation.

The prognosis depends upon prolonged periodic dilatations of the urethra. Cure can usually be anticipated if treatment is persistent and thorough.—*R. M. Harvey, M.D.*

Mattoso Filho, S. El empleo del doble contraste en uretrografía. (On the use of double contrast urethrography.) *Arch. españ. urol.*, April, 1949, *5*, 330–332.

The author reports a technique of double contrast urethrography. Following injection of iodized oil and the taking of roentgenograms, the oil is permitted to drain and air is injected in the urethra. The short article is illustrated by roentgenograms of a case of urethral papillomatosis.—*J. A. del Regato, M.D.*

SKELETAL SYSTEM

Sullivan, A. W. Subluxation of the atlanto-axial joint; sequel to inflammatory processes of the neck. *J. Pediat.*, Oct., 1949, *35*, 451–464.

The author reports 4 cases of atlanto-axial subluxations seen in children in association with inflammatory processes of the neck. He then describes the anatomy of the upper cervical spine and reviews the literature on the subject.

The patients have invariably been suffering from inflammatory processes, commonly in the nasopharynx for a few days before onset of torticollis. At first the torticollis is assumed to be a protective mechanism until it persists after subsidence of the inflammatory process. Precipitating factors include minor trauma, spasm of the paravertebral muscles, and passive manipulation under sleep or anesthesia. The condition is painful and the patient supports the head with the hands to guard against sudden motion. Three types of subluxation may occur: anterior unilateral, anterior bilateral, and posterior unilateral. With anterior unilateral subluxation the neck is rotated away from the subluxated side, the head is tilted toward the affected side and the head is also flexed anteriorly making it difficult to open the mouth. The spinous process of the axis is often palpable away from the midline toward the

affected side. Forward displacement of the anterior arch of the atlas causes a bulge in the posterior pharyngeal wall.

With posterior unilateral subluxation the neck is rotated toward the affected side and there is no pharyngeal bulge. In anterior bilateral subluxation there is no rotation of the neck, the head is tilted forward, and the pharyngeal bulge is most prominent.

The routine roentgenogram is commonly reported negative, according to the author. The joint is difficult to study roentgenologically. The open-mouth view is important but difficult to obtain where depression of the chin is marked. Lateral views are usually negative. Stereoscopic views are desirable. The laminagraph is invaluable. In positive cases in the anteroposterior view there is loss of the joint space on the affected side, with overlapping of the facets. The odontoid may show lateral displacement. Anterior displacement of the atlas may be present on the lateral view. The treatment and prognosis are discussed.—*R. M. Harvey, M.D.*

Colsen, Kurt. Atlanto-axial fracture-dislocation. *J. Bone & Joint Surg.*, Aug., 1949, *31B*, 395–398.

A case of fracture-dislocation of the atlas on the axis is reported in this paper in which the neck had been manipulated under anesthesia for "rheumatism." The patient had marked displacement but, despite this, there were no important neurological complications. One-stage reduction by traction was carried out very slowly and with roentgen control, in the belief that this was less distressing to the patient and safer than gradual reduction by prolonged traction. Colsen recommends surgical fusion as was done in case reported, because of the instability of the atlanto-axial joint after reduction. The upper cervical spine was fused to the occipital bone.—*R. S. Bromer, M.D.*

Heinen, John H., Jr., Dabbs, G. H., and Mason, H. A. The experimental production of ectopic cartilage and bone in the muscles of rabbits. *J. Bone & Joint Surg.*, Oct., 1949, *31A*, 765–775.

A specific osteogenic substance has been hypothesized by several investigators in the last decade. In the rabbit, ectopic chondrification and ossification frequently follow intramuscular injection of irritating substances, such as alcohol, calcium chloride or mixtures which contain these irritants. The authors found that intramuscular injection of extracts of bone, cartilage, or muscle does not produce cartilage or bone more frequently or more extensively than does the extracting fluid alone. The existence of a specific osteogenetic substance ("osteogenin") in extracts of skeletal tissue cannot be accepted as proved.—*R. S. Bromer, M.D.*

Weaver, James B. Experiences in the use of homogenous (bone bank) bone. *J. Bone & Joint Surg.*, Oct., 1949, *31A*, 778–792.

This paper is a report of forty-nine operations upon 46 patients in whom homogenous bone, preserved in a frozen state, was used for grafting. In the author's discussion of the results he states it seems obvious that homogenous bone, preserved by freezing, has not only limitations but also dangers. When used in the form of chip grafts in arthrodesing operations or in certain types of bone defects, excellent results may be expected. However, massive grafts are not so successful in cases of non-union. The same statement is applicable to autogenous grafts. As regards amalgamation with recipient bone, there is certainly no reason to assume that the homogenous graft has inherent qualities which would make it superior. It may be as good as autogenous bone but not better. The only way in which the homogenous graft might lend itself to better results is that the surgeon may have as much of a particular type as he may desire. The results in this series, as they concern massive homogenous grafts for the repair of non-union of fractures, are not as good as the author's experience with autogenous grafts. It is felt that there is a greater tendency for the massive homogenous graft to "die" and, on the whole, the time of amalgamation is longer. This last statement, he emphasizes is an impression without definite data to prove it.

It is fallacy to assume that the danger of infection is less with homogenous bone than with autogenous. Homogenous bone must be handled more than the autogenous bone, thus creating a greater hazard. However, this danger is offset by the fact that the patient does not have to undergo a second incision for removal of bone, with its attendant possibilities of infection and fracture. It is felt that bone from fresh cadavers is just as efficient as that taken from patients. Since it is generally believed that the iliac bone is more efficient as regards

osteogenetic properties, and since the cadaver offers an ample supply, the author has in recent months used iliac bone from fresh cadavers almost to the exclusion of other types. Numerous roentgenograms are shown illustrating the progress of cases in which the homogenous grafts were used.—*R. S. Bromer, M.D.*

Ishmael, William K., Hellbaum, Arthur, Kuhn, John F., and Duffy, Mary. The effects of certain steroid compounds on various manifestations of rheumatoid arthritis. *J. Oklahoma M.A.*, Oct. 1, 1949, *42*, 434–437.

The authors used testosterone propionate, estradiol benzoate and certain of their derivatives in the treatment of 90 patients with rheumatoid arthritis, 6 cases of shoulder-hand syndrome, 4 patients with chronic tophaceous gout and 2 cases of rheumatoid fever. The marked general improvement noted in these cases has been considered of sufficient importance to warrant this preliminary report.

Eighty-one of the 90 patients of rheumatoid arthritis went into a remission. Conjunctivitis, the urethritis of Reiter's disease, erythema nodosum, psoriasis and iritis when present were favorably controlled.

The 6 patients with shoulder-hand syndrome responded promptly to the androgen therapy. The 4 cases of chronic tophaceous gouty arthritis became pain free in from four to forty-eight hours. Both patients with rheumatic fever became pain free on the second day and temperature free on the third day.—*J. N. Ané, M.D.*

Talbott, J. H. The diversity of gouty arthritis and its complications. *Ann. Int. Med.*, Oct., 1949, *31*, 555–569.

The diagnosis of gout is established by all or almost all of the following criteria: (1) positive family history for gout, (2) typical acute attacks of joint distress, (3) response to full doses of colchicine, (4) evidence of osseous tophi by roentgen examination, (5) elevation of serum uric acid above 6.0 mg. per 100 cc., (6) subcutaneous tophi with recovery of sodium urate crystals and (7) renal disturbance.

The association of gout and rheumatoid arthritis is an uncommon occurrence; some even deny the association. When it is suspected, a difficult problem in diagnosis and treatment is presented. The development of the two conditions in one patient is probably coincidental and it is not thought that either disease predisposes to the other.

The passage of urate stones or gravel by gouty patients is seen occasionally. Hench gives the incidence of gravel or stones as 13 per cent. The development of urate stones after onset of joint symptoms does not appear to be directly related to the severity of renal disease. In a limited number of patients, the reverse appears to be true; if urate stones are found, renal impairment is not severe. Another relevant aspect of urate stones is their spontaneous appearance in persons who do not develop gouty arthritis at some later time. The patients that have been followed for several years who have passed uric acid stones and who have had a normal serum urate have not developed gouty arthritis or an elevated serum urate subsequently. It cannot be denied that each person is not in the pre-arthritic stage of gout, and will not develop gouty arthritis in the future. It is the belief of the writer, however, that this will not prove to be a fact and that urate stones do not necessarily mean gout.—*E. J. McDonald, M.D.*

Burk, Lloyd B., Jr. Hyperparathyroidism; analysis of ten cases with special reference to earlier diagnosis. *Am. J. Surg.*, 1948, *76*, 404–411.

This article is an analysis of 10 cases with special reference to the early diagnosis of hyperparathyroidism. The earliest symptoms may be wholly related to the skeletal system, or to the muscular system, or to the renal system, without striking overlap. Skeletal pain and tenderness were the initial symptoms in 5 of the reported cases and were present in all but one case. Renal calculi produced the initial symptoms in 3 cases and in 1, these were the only symptoms for nearly twelve years. In 1 case the initial finding was a so-called giant cell tumor of the right maxilla that was removed ten months before the diagnosis of hyperparathyroidism was established. The occurrence of osteoclastomas, which are characterized by the presence of giant cells, is recorded more often by the dentists and oral surgeons than by medical observers. A positive diagnosis made early in the patient's disease will prevent most of the crippling sequelae of long-standing hyperparathyroidism.—*V. P. Collins, M.D.*

Sear, H. R. Osteogenic sarcoma as a complication of osteitis deformans; some personal

experiences and reflections. *Brit. J. Radiol.*, Oct., 1949, *22*, 580–587.

The incidence of malignant degeneration of Paget's disease is not definite. Figures given vary between 14 per cent and about 2 per cent. The author feels that the latter is more accurate. The incidence of osteitis deformans itself is also not definitely agreed upon.

Sarcoma developing on Paget's disease is said to: involve the pelvis infrequently; metastasize to a bone already involved with Paget's (or this may be a new primary); develop in the fibrous or lithocystic type of osteitis deformans, rather than the true osteolithic type; occur without the development of radiating spiculation. The typical appearance of the neoplasm is cortical erosion, and the development of a central area of necrosis marking neoplastic involvement is quite rare. Two cases of the latter are presented.—*E. F. Lang, M.D.*

Borst, W. H., and Revers, F. E. Albright's disease. *Acta med. Scandinav.*, Aug., 1949, *135*, 91–98.

The literature is reviewed concerning the original description, clinical, roentgen and pathological features of Albright's disease. Two cases are reported.

Albright's disease usually comes on insidiously during childhood, and the active phase is terminated when adult life is reached, or when premature fusion of the epiphyses occurs. The disease is not hereditary nor is it fatal. Spontaneous fractures and skeletal deformities are usually the first symptoms of the disease. The most common site for a spontaneous fracture is the femur. The fractures heal normally. A different number of bones show structural lesions.

The combination of polyostotic fibrous dysplasia, skin pigmentation and precocious puberty is not always present. Bone lesions may not be unilateral; on the other hand, they may be solitary. Pugh's report on bone lesions limited to the skull and called "leontiasis ossea" is mentioned. Precocious puberty is more common in females. Skeletal precocity is more common, and occurs in both males and females.

In the long bones multiple areas of fibrous dysplasia start in the marrow spaces and expand gradually. The osseous architecture is absorbed and many cyst-like areas of rarefactions become visible with roentgen examination.

Changes in the skull are different. The base of the skull is thickened by bony overgrowth, through which asymmetric, localized thickening of the skull is palpable. The ossa frontale, ethmoidale, sphenoidale and occipitale are thickened with dense bone, and the sinuses of the maxilla, nose, os ethmoidale, sphenoidale or os frontale may be filled with this sclerotic mass. Pressure on the optic and acoustic nerves may lead to papilledema, optic atrophy, deafness and even exophthalmos.

Three features that distinguish the disease from osteitis fibrosa generalisata (hyperparathyroidism) on roentgen examination are: areas of increased as well as decreased density, some parts of the skeleton are normal, and the disease practially never involves the epiphyses.

The only constantly abnormal chemical finding is increased serum alkaline phosphatase. Several cases are noted with hyperthyroidism.

The etiology is obscure. Albright postulated a disseminated neurological lesion. Lechtenstein postulated deformities in several organ systems. The authors believe both local and endocrine factors are present.—*Charles Nice, M.D.*

Simmonds, F. A. Shoulder pain with particular reference to the "frozen" shoulder. *J. Bone & Joint Surg.*, Aug., 1949, *31B*, 426–432.

The "frozen" shoulder is characterized by (1) increasingly severe pain in the shoulder spreading down the arm, sometimes after an injury, in a patient aged fifty to sixty years, (2) persistence of the pain and decrease of glenohumeral movement until only about 20 degrees remain, (3) the pain becoming less severe but with persistence of stiffness, (4) subsidence of the pain and slow regaining of movement. The author considers it is due to an inflammatory lesion in the musculotendinous cuff invoked by a local area of degeneration. He also thinks that the available evidence suggests that the primary site of the degenerative lesion is in the supraspinatus tendon.

He describes the sequence of events in the development of the condition as follows: (1) the supraspinatus undergoes irregular and widespread degeneration with focal necrosis; (2) the tendon reacts by inflammation as it would to a foreign body; (3) the inflammatory reaction is painful, spreads to the bursa, and causes inefficiency in the function of the supraspinatus; (4) the painful area is constantly injured by impact against the acromion process and the coracoclavicular ligament, and the limb is therefore rested in the sling position;

(5) the capsule and cuff, because of a nearby inflammatory process coupled with lack of use, become inelastic with consequent loss of movement in all directions from the sling position. If necrotic areas in the tendon are absorbed, and the tendon is revascularized, an inflammatory reaction is no longer invoked and a painless stiff shoulder develops which slowly regains its movement.

Other causes of shoulder pain which must be differentiated from "frozen" shoulder are peritendinitis of the long head of the biceps, degeneration or tears of the supraspinatus, and calcified deposits in the supraspinatus.—*R. S. Bromer, M.D.*

Harrison, Stewart H. The painful shoulder; significance of radiographic changes in the upper end of the humerus. *J. Bone & Joint Surg.*, Aug., 1949, *31B*, 418–422.

Harrison states that roentgen changes in the upper end of the humerus at the site of the attachment of the musculotendinous cuff have been described. However, the literature is concerned mainly with bone changes detected after complete tears of the cuff whereas his intention in this paper is to emphasize the importance of early bone changes that may occur before there is clinical evidence of rupture of the tendons. His studies show clear evidence of pathological degeneration in and around the shoulder joint involving bone and soft tissue, which has an important bearing on the diagnosis and prognosis.

In his paper, he describes the characteristic pathological, clinical and roentgen features of degenerative lesions. He investigated 145 shoulder injuries and roentgen examinations were made in 111 cases. There was a normal appearance in 70, a degenerative lesion in 26, acromioclavicular arthritis in 2, fracture of the greater tuberosity in 3, calcification of the supraspinatus in 2, and in 4 there was avulsion of bone from the greater tuberosity. The characteristic roentgen appearances that indicate a degenerative lesion at the attachment of the musculotendinous cuff are: irregularity of the cortical bone of the greater tuberosity; erosion of bone of the articular surface of the head of the humerus; loss of the normal outline of the anatomical neck; cystic cavitation and areas of sclerosis.

Harrison concludes that all injuries of the shoulder joint, however trivial, occurring in patients over middle age should be studied carefully by roentgen examination. In injuries of the shoulder joint the presence of a degenerative lesion prolongs the duration of symptoms, and the prognosis is less satisfactory than when there is no roentgen evidence of abnormality. —*R. S. Bromer, M.D.*

Nicoll, E. A. Fractures of the dorso-lumbar spine. *J. Bone & Joint Surg.*, Aug., 1949, *31B*, 374–394.

This paper is based on a study of 166 fractures or fracture-dislocations of the dorso-lumbar spine occurring in 152 miners during the six year period ended in 1945. One of the objects of the paper was to investigate the relationship between anatomical and functional results, in other words to examine the validity of the assumption that a good anatomical result is indispensable to a good functional result.

The fractures were classified on an anatomical basis into four main types: anterior wedge fracture, lateral wedge fracture, fracture-dislocation, and isolated fracture of the neural arch. These are described in detail. The lateral wedge fracture has not been previously described and it constituted 14 per cent of the series. It is a flexion-rotation injury, the usual history being that the patient's head is forced forward and to one side. The prognosis in this fracture is not good.

The three most important factors concerned in redisplacement after reduction of vertebral fractures are comminution of the vertebral body, crushing of the intrevertebral disc and rupture of the interspinous ligament.

At the present time, Mansfield concludes, orthodox treatment is based on the assumption that a perfect anatomical result is indispensable to a perfect functional result. The analysis of the results of his series shows that there are no grounds for this assumption.

The paper is well illustrated with roentgenograms of the various types of injuries and treatment of each type is given in detail.—*R. S. Bromer, M.D.*

Raven, Ronald W., and Willis, R. A. Solitary plasmocytoma of the spine. *J. Bone & Joint Surg.*, Aug., 1949, *31B*, 369–375.

Publication of a case of solitary plasmocytoma of the spine, the authors believe, is justified because of the rarity of the lesion. In addition, they include a brief review of 18 acceptable cases in the literature of solitary plasmocytoma

of bone. Of the 18 patients, 15 were men and the 5 spinal tumors of the series were all in men. They mention in their summary that the diagnosis requires biopsy identification of plasmocytoma, and exclusion of all possibility of generalized myelomatosis by complete roentgenographic examination of the skeleton, repeated if necessary at intervals during the ensuing two or three years or longer. A tumor of brief duration, proved to be solitary by careful necrospy, cannot be placed with certainty in the group of truly solitary plasmocytomas. It might have been a precocious first lesion of myelomatosis.

The roentgen appearances may be grouped as stated by the authors into two distinct types. In one type there is a markedly destructive lesion involving the bone, the process being well demarcated and sharply defined. In some respects it resembles a carcinomatous metastasis of the osteolytic variety or the osteolytic type of osteogenic sarcoma. The second type has a cystic and trabeculated appearance, the trabeculae being thickened and irregular. The lesion is large and is situated in the medulla of the bone, often expanding the cortex.

These solitary tumors are known to be radiosensitive and after high voltage roentgen treatment there may be regression with recalcification. Although irradiation may control the disease for a time, there is no evidence that it is curative.—*R. S. Bromer, M.D.*

Leydig, Stanley M., and Odell, Richard T. Synovial osteochondromatosis. *Surg., Gynec. & Obst.*, Oct., 1949, *89*, 457–463.

Synovial osteochondromatosis is a disease in which osteocartilaginous bodies develop in the synovial membrane and are extruded into the joint as loose bodies. They may sometimes remain pedunculated and attached to the synovium. This condition usually occurs in the knee but may occur in other joints. In one of the authors' cases the condition was found bilaterally in the elbows.

Synovial osteochondromatosis may be considered a benign neoplasm because it is an abnormal tissue growing without regular structure and because metastases do not occur.

Etiology. Trauma and infection are factors in aggravation but are not thought to be primarily responsible.

Pathology. There are many white cartilaginous spheroid bodies varying in size from flakes of ½ to 1 inch in diameter either free or attached to the synovium. They are located in the synovial folds and also in any communicating bursae of the joint.

Roentgen appearance. The bodies are demonstrable if they are calcified or contain bone. However, if they are entirely cartilaginous, the roentgen findings may be entirely negative.

Incidence. The condition is seen most often in males between the ages of thirty and fifty. However, no age group is exempt.

Differential diagnosis. Osteochondromatosis is not the same as osteoarthritic spurs or osteophytes which have broken off and become loose bodies.—*Mary Frances Vastine, M.D.*

Jacobs, Julian E., and Lee, F. Wayne. Hemangioma of the knee joint. *J. Bone & Joint Surg.*, Oct., 1949, *31A*, 831–836.

Two cases of cavernous hemangioma of the knee joint are presented in this paper. Although the condition is rare, it is deserving of attention because of the difficulty in differential diagnosis. Approximately 30 authentic cases have been reported in the literature and of this number, less than 5 were diagnosed correctly prior to arthrotomy.

Articular hemangiomas may be either juxta-articular or intra-articular. There may be also an intermediate type which involves both inter-articular and periarticular structures. Histopathologically, the articular hemangiomas have been classified as cavernous, capillary and telangiectatic. They are usually not suspected before operation. The impressions most commonly mentioned are lesions of the menisci, loose bodies or articular tumors without specification of the type.

The authors believe that articular hemangiomas can be diagnosed prior to surgery in practically all cases, provided the correlation between the clinical picture and the pathological process is fully appreciated. They regard the following as significant signs: (1) the presence of a circumscribed mass, which is covered by normal skin and which increases in size when the extremity is in the dependent position; (2) the presence of blood after puncturing of the mass; (3) the disappearance of the contrast substance roentgenographically after injection into the vascular area. It is relatively easy to see the area infiltrated with a contrast medium injected intravenously, but the shadow will often disappear in about fifteen minutes due to the rapid dilution of the substance in the blood current of the angioma. Although there are

many proponents of treatment with roentgen rays and radium, the authors regard surgical extirpation as the treatment of choice.—*R. S. Bromer, M.D.*

Gordon, Everett J., and Greiberg, Joseph A. Posterior dislocation of the hip with fracture of the head of the femur. *J. Bone & Joint Surg.*, Oct., 1949, *31A*, 869–872.

Traumatic dislocation of the hip comprises from 2 to 5 per cent of all traumatic dislocations. A complicating fracture is not uncommon. This usually involves the posterior rim of the acetabulum. A fracture of the head of the femur accompanying posterior dislocation of the hip is rare and for this reason such a case is reported by the authors.

It is generally agreed that the cause of fracture of the head of the femur in conjunction with posterior dislocation of the hip is either direct trauma to the greater trochanter, or, more frequently, a powerful upward force exerted against the anterior aspect of a knee held in 90 degrees of flexion. The fracture of the head of the femur appears to occur in its inferior or antero-inferior third. The fragment may be attached to the ligamentum teres and may or may not remain within the acetabulum, which thus affects the choice of procedure for reduction.

In their case, the first roentgenogram showed the posterior dislocation of the femur but not the fracture of the head. Roentgen examination, one week later, confirmed the reduction of the femoral head but also showed a free fragment of bone within the joint capsule. Stereoscopic views showed the fragment came from the head and was lying anterior and inferomedial to the head and neck of the femur. Three weeks after the injury the fragment of the head and another fragment of loose articular cartilage were removed at operation. Two years and ten months after the injury the patient had complete range of motion in the affected hip as compared with the opposite and had no pain on weight-bearing or walking.—*R. S. Bromer, M.D.*

Howorth, M. Beckett. Slipping of the upper femoral epiphysis. *J. Bone & Joint Surg.*, Oct., 1949, *31A*, 734–747.

In this paper the author analyzes 243 cases of slipping of the upper femoral epiphysis, treated at the New York Orthopedic Hospital. One hundred and sixty-nine hips were operated upon in various stages of the disease, and gross and microscopic studies of the pathological tissues were made. Pathological findings in detail are given in the preslipping stage, in the slipping stage and in the healing stage. In the residual stage, the lesion is healed and the epiphysis is solidly united to the neck.

Howorth states the results of treatment for slipping of the upper femoral epiphysis should be strictly evaluated in terms of the normal hip as to symptoms, signs and roentgenographic appearance. The lesion always heals spontaneously, and treatment is of no value unless it produces a better result than would have been accomplished by nature. The following methods are discussed under treatment: no therapy; endocrine therapy; bed rest; cast or brace; pegging operation; nailing the epiphysis; reduction by manipulation; reduction by strong traction; traction-reduction with nail fixation; open reduction; osteotomy of the neck; subtrochanteric osteotomy. Howorth concludes that the treatment of choice is pegging of the epiphysis in the preslipping stage or before much slipping has occurred. The results of this operation have been excellent, and far better than with any of the other methods of treatment. Drilling without pegging has little or no effect on the course of the disease. Even the slipped epiphysis can be pegged and the deformity can be corrected later by subtrochanteric osteotomy. The hip should never be held in a position of tension, especially extension, abduction, and internal rotation as this wrings out the blood vessels along the neck and still further embarrasses the circulation.—*R. S. Bromer, M.D.*

BLOOD AND LYMPH SYSTEM

Linde, Paul. Post-thrombotic varices; results of phlebography and radical operative treatment. *Acta chir. Scandinav.*, Feb., 1949, *97*, 430–438.

The author points out possible sources of error in phlebographic studies of the deep venous channels of the lower limbs. Since the opaque medium has a higher specific gravity than blood, examination in the horizontal position may cause the dye to accumulate in tracks present along the lower side of the leg. Also, the opaque medium tends to follow superficial channels more easily than deep ones.

The correct technique for study of the deep system obviates these tendencies by utilizing elastic binders to compress the superficial sys-

tem, and employing the vertical position at all times. The actual injection is most commonly made far peripherally, preferably into a vein of the big toe.

Studies carried out in this fashion in 155 cases with post-thrombotic varicosities showed patency of the deep channels to be present in 73 per cent. This is assumed to be due to recanalization of the previously thrombosed vein. The author emphasizes the fact that failure to visualize deep venous channels by phlebography does not necessarily mean that none are present.—*E. C. Lasser, M.D.*

Body, A. M., Ratcliffe, A. Hall, Jepson, R. P., and James, G. W. H. Intermittent claudication; clinical study. *J. Bone & Joint Surg.*, Aug., 1949, *31B*, 325–355.

In this paper a description is given of historical discoveries relating to intermittent claudication, and various theories that have been advanced are discussed. The authors suggest a hypothesis based on the work of Lewis who demonstrated that intermittent claudication was due to inadequacy of blood flow during exercise causing accumulation in the tissue spaces of a pain factor. They distinguish three groups of obliterative arterial disease: primary thrombosis of the popliteal artery; juvenile obliterative arteritis; and senile obliterative arteritis.

The methods adopted for assessment of the severity of the disease, including study of the clinical features, arteriographic findings, results of novocain infiltration and examination of the patient on a walking machine, are reported in detail.

In primary thrombosis of the popliteal artery, arteriograms show that occlusion is confined to the popliteal artery, the other vessels appearing healthy. The fact that one end of the thrombosed segment is often found at the level of the knee joint suggests strongly that the causative process begins at this level. In juvenile obliterative arteritis, arteriography shows in early cases narrowing and finally obliteration of the small arteries of the feet. In more advanced cases arteriograms show relentless proximal spread of the disease; the tibial arteries, and eventually the popliteal arteries, become involved. Collateral vessels show the corkscrew appearance that is associated characteristically with rapid hypertrophy and dilatation, a feature less marked in distal obliterative arteritis of arteriosclerotic origin.

Senile obliterative arteritis is divided into three groups: in diffuse obliterative arteritis arteriography shows narrowing and irregularity of the main vessels with a beaded appearance of the larger branches; in secondary popliteal thrombosis, the popliteal artery is thrombosed in nearly half the patients with diffuse arterial disease and the arteriographic picture resembles that of primary popliteal thrombosis; in secondary femoral thrombosis, arteriography shows occlusion of the superficial femoral artery from the adductor opening to the point where the profunda femoris leaves the main trunk.

Methods of treatment of 276 patients with intermittent claudication are discussed and tabulated.—*R. S. Bromer, M.D.*

Danopoulos, Ev. Résultats thérapeutiques des grandes transfusions "sterno-sternales" dans quelques cas d'aplaises médullaires et des leucémies aiguës. (Therapuetic results of large sternosternal transfusions in a few few cases of medullary aplasia and acute leukemia.) *Acta med. Scandinav.*, 1949, *134*, 415–422.

The term "sternosternal transfusion" indicates the removal of sternal marrow from a donor, with subsequent injection of the marrow aspirate into the recipient. Earlier workers used 2–5 cc. of marrow aspirate. Danopoulos uses 20–60 cc., once or twice daily, up to 20–25 treatments. The therapy was applied to 3 cases of acute total aplasia, 1 case of chronic aplasia, and 3 cases of acute myeloid leukemia.

In the first 3 cases the patients were cured completely. Their disease was due in 1 case to general leishmaniasis and was aggravated after treatment with neostibosan; a second was aggravated by treatment with neosalvarsan. The third was idiopathic.

In the fourth case such series of transfusions were made seven times. In the first six series the platelets were increased each time from 20–50,000 up to 600,000–1,500,000 per cu. mm. This improvement did not occur the seventh time.

In the 3 cases of acute myelogenous leukemia the leukemoid blood picture disappeared from both bone marrow and peripheral blood in one, from the peripheral blood only in the second, and from neither in the third. All ended fatally. —*Charles Nice M.D.*

v. Albertini, A., and Ruttiner J. R. Über das Wesen des Grobfollikulären Lympho-

blastoms (Brill-Symmers-Disease). (Concerning the behavior of gross follicular lymphoblastoma (Brill-Symmers-Disease).) *Deutsche med. Wchnschr.*, Jan. 6, 1950, *75*, 27–29.

The authors report their cases of gross follicular lymphoblastoma, a disease about which very little was known in Europe until recently.

The following characteristics were observed: the disease is more common in males than in females; it occurs predominantly in the fifth decade; the disease is chronic and has few symptoms with an average duration of about five years, but with remissions up to eleven years.

It begins with enlargement of groups of lymph nodes, mostly cervical, but also axillary and inguinal and not infrequently retroperitoneal nodes. The spleen was found to be enlarged in only 30 per cent. Splenic enlargement must be considered as a sign of beginning generalization and of poor prognosis. The blood count was rarely abnormal, and, if so, only slight leukopenia with relative lymphopenia or lymphocytosis was found.

The involved nodes were found to be extremely radiosensitive, and the disease could be controlled by irradiation for a long time.

Four patients who came to autopsy were found to have died of reticulum cell sarcoma.

The authors conclude that the disease does not belong to the group of "lymphatic hyperplasias," but should be considered as a latent presarcomatosis.

Similar consideration should be given to two other precancerous conditions, diffuse hyperplasia of reticulum cells in reticulosis which can develop into monocytic leukemia, and diffuse lymphatic hyperplasia in lymphadenosis which can develop into lymphatic leukemia.—*H. P. Mueller, M.D.*

RADIATION THERAPY

Beeler, John W., Tillisch, Jan H., and Popp, Walter C. A new drug in the treatment of radiation sickness. *Proc. Staff Meet., Mayo Clin.*, Sept. 14, 1949, *24*, 477–483.

The syndrome of radiation sickness may include varying degrees of vomiting, nausea, anorexia, weakness, exhaustion or prostration. The symptoms are more likely to occur when treatment is directed to the upper part of the abdomen; the dose per field, size of field, and nutritional state of the patient are also important.

The theories advanced as to the cause of radiation sickness are as numerous as the therapeutic measures used in attempting to control it.

The striking similarity between the symptoms of motion sickness and those of radiation sickness suggested a trial of dramamine. Treatment of a series of 82 patients resulted in "excellent" and "good" results in 79 per cent, as compared to a 13 per cent control group receiving placebos.

Maximal effectiveness was obtained with 100 mg. of dramamine when given thirty to sixty minutes before the treatment, and repeated one and a half hours after treatment, and again in three hours. Drowsiness was an objectionable feature in a few instances. In patients with the most severe degree of nausea and vomiting, a combination of intravenous pyridoxine (200 mg.) and dramamine in the dosage mentioned gave better results than either drug alone.

The evidence suggests that the action of the drug is due to a specific depressant effect on the vomiting reflex, rather than its antihistaminic or psychologic action.—*Benjamin Copleman, M.D.*

Collins, E. G., Thomason, I. S., and Swindell, G. E. Radon therapy of nasopharyngeal lymphoid hypertrophy in children. *J. Laryng. & Otol.*, Jan., 1949, *63*, 17–23.

Twenty millicuries of radon filtered with 0.5 mm. platinum is used in an applicator 3 cm. long. One such applicator is passed through each nostril so that the capsules are parallel to each other and are separated from the nasopharyngeal wall by at least a few millimeters. The applicators are left in place for one hour. Isodose curves are included in the article. No patient has been treated more than twice.

The authors report the results in 41 cases of chronic conduction deafness of eustachian origin and chronic nasal catarrh. Follow-up varies from eighteen to twenty-four months. These therapists urge that symptomatic relief be used as a gauge of the results and not the appearance of the nasopharyngeal lymphoid tissue. They believe the results to be superior to any form of treatment they have used previously.—*W. H. Granger, M.D.*

Craig, M. S., Jr., and Buie, L. A. Factitial (irradiation) proctitis; clinicopathologic study of 200 cases. *Surgery*, March, 1949, *25*, 472–487.

The authors report a clinicopathologic study

of 200 cases of factitial proctitis which occurred as a sequel to treatment by irradiation for extrarectal pelvic lesions. All patients were women; 186 had malignant lesions and 14 had benign lesions. Factitial rectal and sigmoidal lesions occurred after irradiation with either roentgen rays or radium alone or after a combination of these agents. No attempt was made to correlate the lesions with the amount or type of irradiation.

Symptoms, in order of frequency, were rectal bleeding, diarrhea, rectal pain, tenesmus, constipation and abdominal cramping. The bleeding was from telangiectatic mucosal vessels in most cases in which this symptom was mentioned. Diarrhea was mild in 90 per cent of cases and was commonest when the bowel was ulcerated or contracted. Rectal pain was predominant among patients who had sigmoidal or rectal ulceration. Tenesmus frequently accompanied ulceration while constipation was commoner among patients who had stricture. Eleven patients who complained of urinary distress had factitial cystitis with or without ulceration. The onset of symptoms occurred as early as during the course of irradiation and as late as six and three-fourths years after treatment; it did not appear to have any relationship to the type of factitial lesion.

The lesion may be in any part or parts of the rectosigmoid but 56 per cent involved the middle third of the anterior wall of the rectum. The six types of factitial proctitis and sigmoiditis include those without ulceration or stricture, with ulceration and without stricture, with rectovaginal fistula and stricture.

Of 37 cases in which roentgenoscopic examination was carried out with the administration of barium enemas, evidence of constriction of the bowel beyond the reach of the sigmoidoscope with or without mucosal ulceration was apparent in 10. In each instance the radiologist was able to distinguish the lesion from carcinoma.

Of 61 cases in which follow-up examinations were carried out over a period of one month to fourteen years, increased factitial changes were present in 18. A diagnosis of rectal carcinoma had been made in 19 of the 200 cases. No evidence of primary or secondary neoplasms was found in any case.

Four surgical specimens were studied grossly and biopsy was performed in 24 cases. In cases in which ulceration had occurred, vessels showed hypertrophy of the intimal tissue, thrombosis, sclerosis and degeneration which became more marked as the ulcer was approached. In all sections in which thrombosis was a prominent feature, a few vessels had lumens of decreased size but they were patent. The vessels usually appeared normal at a distance of 3 to 5 cm. from the margins of the ulcers. Connective tissue showed edema and hyalin change with abnormal fibroblasts. Fibrosis was absent except at the margins of the ulcers. There was little evidence of healing of the epithelial lining destroyed by ulceration. Epithelium showed mucous stasis where it was ulcerated. Muscle sometimes showed edema, vacuolation of fibers, degeneration and atrophy with hyalinization of connective tissue. In the marked reactions ganglion cells appeared distorted, vacuolated and degenerated. Necrotic areas were present in the ulcers.

Complete occlusion of all but 2 vessels with medial and adventitial coats was demonstrated in the specimens in which there was stricture without gross ulceration. The mucosa was atrophied, and hyalinized tissue was present in the submucosa and in the intermuscular connective tissue.

Telangiectasis was the most prominent feature of the specimens obtained for biopsy. Many sections showed hyperplasia of epithelial cells and the mucosal glands. A malignant process was found in 1 specimen which had been removed from a rectovaginal fistula that appeared three months after irradiation for cancer of the uterine cervix.

Medical management is advocated for control of symptoms. Important features are rest, adequate but low residue diet, warm small cleansing enemas after defecation and before injection of medicated solutions, avoidance of cautery or irritating solutions, constant supervision and reassurance. Surgical treatment is reserved for complications such as (1) obstruction, (2) hemorrhage and (3) perforation and peritonitis. Certain surgical measures are employed to make it possible for the patient to live more comfortably. A table summarizes the surgical procedures in 14 cases.

Factitial lesions usually heal if the malignant lesion has been destroyed. The risk of this complication must be accepted when sufficient irradiation is applied to effect a cure of extrarectal pelvic cancer.—*C. B. Holman, M.D.*

Davis, Loyal, Martin, John, Goldstein, Stanton L., and Ashkenazy, Moses. A

study of 211 patients with verified glioblastoma multiforme. *J. Neurosurg.*, Jan., 1949, *6*, 33–44.

The authors studied 211 patients with verified glioblastoma multiforme. Of these, 187 were operated upon and 110 survived surgery. Twenty-three patients lived for more than a year following surgery, and 11 for more than two years, during which time many of them were able to fulfill economic and social obligations. On the basis of the microscopic characteristics the tumors were divided into angiothrombotic and angioproliferative groups. The survival time was longer in the latter group. The patients in the extreme age groups had a poor prognosis.

Forty-three patients received roentgen irradiation and 15 received radium therapy. Of those who received more than 4,000 roentgens, 12 survived for more than one year, while of those who received less than 4,000 r, none survived. Of those patients who survived surgery and received no irradiation, only 5 survived for more than one year. Only 3 of those who received radium irradiation survived for the same period. There were definite microscopic differences before and after roentgen irradiation in five tumors. Seven tumors showed a transition from a more benign glioma to glioblastoma multiforme during treatment of the patients. The patients in whom all or most of the tumor was removed survived for longer periods of time than those in whom only a surgical biopsy was taken and there was a longer survival period in those patients who received adequate roentgen irradiation. However, despite these figures, it must be remembered that those who had inadequate roentgen therapy may not have lived long enough following surgery to either start, or complete, their courses, because of the relatively very malignant nature of their respective tumors.—*K. K. Latteier, M.D.*

Cronin, T. D., and Brauer, R. O. Radiodermatitis and necrosis. *Surgery*, Oct., 1949, *26*, 665–672.

The authors have reported their experience in the management of 43 cases of radiodermatitis and necrosis.

The lesions are classified in three groups after the method of Porter. Group 1 includes 25 lesions, each of which is said to have resulted "from a single massive dose, intentional or otherwise, or a few exposures at short intervals." Group 2 includes 16 lesions, each of which apparently resulted from "many exposures over a long period of time in the treatment of various benign conditions." Group 3 includes 2 cases that were treated by professional roentgenologists. In the authors' opinion the production of a lesion was justified in only 7 cases. A table indicates that treatment by irradiation was not justified for any of the 15 benign lesions or for 19 of the 26 malignant lesions. There is little definite information presented or implied to indicate the exact nature of each of the original lesions. Neither the technical factors of the treatment by irradiation nor the agent or agents used in each instance are stated. Thus, the basis for a judgment as to whether treatment by irradiation was justified is not obvious.

The general pathologic characteristics of the lesions of radiodermatitis and necrosis are hypertrophy of the epithelium, atrophy of the corium, loss of the sebaceous glands, hair follicles and sweat glands and an obliterative endarteritis. The skin appears atrophic, tight and dry and shows telangiectatic vessels. There may be keratoses and ulceration. The authors state that "pain is an outstanding feature of all deep burns." Because of the irreversible changes in tissue the diseased area must be removed. Otherwise treatment is only palliative. Palliative procedures are useful in the treatment of acute ulcerations, for relief of symptoms and for those patients who refuse operation or who cannot undergo operation. For the treatment of acute ulcerations, moist dressings containing saline or boric acid solutions, soothing ointments and lotions and the use of the fresh leaves of the plant aloe vera, are suggested. The authors have not used radon ointment.

Surgical measures suggested are electrodesiccation and coagulation, excision and amputation. It is stated that irradiation should be avoided in the treatment of benign conditions, and its use is condemned in those instances of cancer of the skin where it has initially failed. The management of chronic radiodermatitis and necrosis is considered to be a surgical problem.—*C. B. Holman, M.D.*

Freeman, Bromley S. Fluorescein as an adjunct in the treatment of radionecrotic ulcers. *Surg., Gynec. & Obst.*, Nov., 1949, *89*, 566–569.

Fluorescein, when injected intravenously, is made visible by a beam of long wave ultra-

violet radiation wherever the rays can penetrate. The drug is completely non-toxic in the dosage used. The appearance of fluorescence in tissues remote from the site of injection demonstrates the existence of circulating blood within the area under observation. Upon reaching a capillary, the dye diffuses through the wall into the interstitial spaces. Dead tissue cells do not stain even if the blood supply in the area is preserved.

Summary. Fluorescein as an agent for determining the residual vascularity and extent of deep radionecrotic lesions places on a more objective plane the demarcation of devitalized and partially devitalized tissues. Its use enables the surgeon to determine the actual extent, levels, and degree of revascularization. The incidence of failure, as well as the time necessary for these multiple staged procedures, is reduced.—*Mary Frances Vastine, M.D.*

Daubresse, E. Au sujet du traitement de certains angiomes géants. (On the treatment of certain giant angiomas.) *J. belge radiol.*, Sept., 1949, *32*, 175–181.

The author applies the term "giant angioma" to an extensive cavernous type angioma which may occupy half a face and neck and involve whole structures, such as the eyelids and lips. These angiomas develop rapidly from birth and attain their gigantic size in a few weeks. The condition is serious and usually not compatible with life. It may be complicated by necrosis and destruction of normal structures.

The therapeutic problem is first to stop the growth of this tumor and then to cause its disappearance by a method which maintains the integrity of the normal tissues. The author believes that radium therapy is the only satisfactory method. Molds are made of Columbia paste with radium sources of 2 mg. each and 0.5 mm. of platinum filtration distributed according to the rules which assure homogeneous irradiation (these rules are not stated). The radium-skin distance is 7 to 10 mm. The dose per treatment is 0.1 to 0.3 millicuries destroyed per square centimeter. The mold is applied under general anesthesia and it is maintained in place by adhesive plaster, cotton wool and a Velpeau or starched bandage. The duration of application is two to four days. The author stresses the importance of this slow irradiation to avoid necrosis of the tumor. If the tumor is very deep, a preliminary treatment with radium needles is given. A second treatment is given two to four months after the first. Occasionally more treatments are necessary. Two cases are demonstrated in which a highly satisfactory result was obtained.—*Sidney M. Silverstone, M.D.*

Marquès, P., and Bétoulières, P. Les leucémies (position actuelle de la radiothérapie). (The leukemias—present status of radiation therapy.) *J. de radiol. et d'électrol.*, July–Aug., 1949, *30*, 417–446.

The authors, after reviewing the essentials of hematopoiesis, suggest that luekemias be classified simply acording to the cell type which gives rise to their origin, and they propose four groups: leukemias of highly undifferentiated stem cells (Ebstein's disease the principal type), leukemias of the granulocytic series (myeloid leukemia), leukemias of the lymphocytic series (lymphatic leukemia) and leukemias of the histiocytic series (monocytic leukemia found in about 50 per cent of cases of hyperplastic dysplasia of the reticulo-endothelial system with a blood picture of anemia, monocytosis and acute leukemia). All therapeutic measures are discussed for the various types of leukemia—radioactive isotopes, urethane, total body roentgen therapy, massive transfusions and surgery. Statistics concerning 128 cases of chronic leukemia treated by roentgen therapy are presented. This article contains a bibliography of more than 220 items covering every aspect of the therapy of leukemia. All of the references in this bibliography have appeared in the literature since 1930.—*W. M. Loehr, M.D.*

Dickson, E. D. D., and McGibbon, J. E. G. The treatment of recurrent otitic barotrauma by irradiation. *J. Laryng. & Otol.*, Nov., 1949, *63*, 647–671.

This rather lengthy article relates the authors' experiences in undertaking to treat patients suffering from inability to equalize atmospheric and intratympanic pressures while flying or during decompression or recompression in a pressure chamber. The primary contributory factor is the failure of the individual flyer to adopt the necessary measures to open the tube. Secondary contributory factors are (1) physical deformity of the tube and (2) acute or chronic upper respiratory tract infection which may cause swelling of the mucous membrane and proliferation of the lymphoid

tissue in and around the orifice of the eustachian tube.

Next the anatomy of the eustachian tube is considered from the viewpoint of variations in skull size and shape and from the viewpoint of soft tissue variations. Then the method of placing radium containers in the nasopharynx is described. After each application, the position of the radium is checked by means of lateral and verticomental roentgenograms. Dr. C. W. Wilson, Physicist to the Westminster Hospital, calculated the gamma radiation which would be delivered to the eustachian tube by this method. By appropriate isodose curves, it was found that the gamma-ray dosage falls to 16 per cent at a point 5 mm. from the applicator and to 8 per cent at 8 mm. Therefore, in order to deliver adequate dosage to the eustachian tube, such a high local dosage would be delivered at the nasopharyngeal end of the tube that excessive radiation might cause permanent damage to the nasopharynx. The physicist suggested the high voltage roentgen therapy be used if it was desired to irradiate the entire eustachian tube. Factors used were 200 kv. filtered by 2 mm. Cu plus 1 mm. Al (half-value layer of 1.9 mm. Cu) at 50 cm. distance. Field size of 4 cm. was chosen as adequate. Isodose curves for such radiation are given in this article. For unilateral irradiation, a lateral field and an anterior oblique field were used. The latter field entered over the malar prominence just below the eye. For bilateral irradiation, the same two fields were used bilaterally. Each field was treated daily with 100 r.

Before treatment was commenced, the patient had to fulfill the following conditions: (1) he must show no evidence of any previous middle ear infection, (2) barotraumatic changes must have been noted in the middle ear, (3) absence of paranasal sinus infection both clinically and roentgenologically, (4) absence of any lesion in the nasal fossae, nasopharynx and pharynx, (5) inability to auto-inflate the middle ear, and (6) fitness for full flying duties other than recurrent otitic barotrauma. In 41 cases, the dose to the eustachian tube was 860 to 1.245 r. Of these 15 (36.5 per cent) were considered to be successful while 26 (63. 4 per cent) were failures. In 23 cases, the dose was 1,250 to 1,520 r. Thirteen (56.5 per cent) were successful while 10 (43.4 per cent) were failures. It therefore appears that the larger doses are more desirable. Skin reactions as evidenced by erythema were noticed in a "proportion of cases." Mucosal reactions were rare. Headache occurred in a small number of patients during treatment but was not a serious symptom. A small number of patients noted relief of symptoms at an early stage of the treatment.—*W. H. Granger, M.D.*

Körbler, Juraj. Über strahlenresistente Haemangiome. (On radioresistant hemangiomas.) *Radiol. clin.*, Nov., 1949, *18*, 392–397.

The various types of hemangiomas respond differently to irradiation. The nevus flammeus, or "port wine mark," is generally considered radioresistant. In the hemangioma stellatum, Berven recommends thermal puncture of the central vessel after which the lesion fades out completely. Cavernous hemangiomas likewise respond poorly to irradiation.

The most satisfactory results are obtained in the hemangioma simplex. According to Berven a dose not exceeding 80 per cent of an erythema dose is sufficient to bring about the desired effect. The author has treated over 600 such lesions in Zagreb by using mostly gamma rays of radium. In an average lesion of 2 cm. in diameter a dose of 120 mg. hr. filtered through 0.5 mm. Pt is given. Needles containing 2 to 3 mg. radium are used in a distribution which covers the entire lesion. Usually 10 mg. is employed for three hours daily on four consecutive days. For lesions less than 1 cm. in diameter 10 mg. radium element plaques filtered by a soft metal are used, the exposure amounting to only ten to twenty minutes. The stronger filtration, however, leads to better cosmetic results.

In the present article 2 cases of hemangioma simplex are reported which despite much larger doses of radium than indicated above failed to respond to treatment. In the first case, that of boy twelve years of age, a dose of 2,975 mg. hr., filtered through 1.5 mm. Pt, was given at a distance of 2 cm. to a lesion of the posterior aspect of the right leg. The second patient was a male, aged twenty, who had a lesion of the right sole extending from the region of the second metatarsal to the heel. In this case, three consecutive doses of 4,008, 3,220 and 3,800 mg. hr. filtered by 1 mm. Pt were given at intervals of about two months from each other, all at a distance of 1 cm.—*T. Leucutia, M.D.*

RADIOISOTOPES

Gray, L. H. The experimental determination by ionization methods of the rate of emission

of beta- and gamma-ray energy by radioactive substances. *Brit. J. Radiol.*, Dec., 1949, *22*, 677–697.

Measurements of the absolute rate of gamma-ray energy emission of samples of Na^{24}, Co^{60}, and I^{131} were made with a graphite lined ionization chamber. Subsequently samples of the three radioactive isotopes were incorporated into the walls of ionization chambers using gelatine as a medium. The figures arrived at are in agreement with accepted decay schemes for these isotopes.

The various factors affecting the accuracy of these measurements are described in detail as are the fundamental principles. The figures arrived at are considered to be accurate to about 5 per cent.—*E. F. Lang, M.D.*

Oddie, T. H., and Scott, R. Kaye. External measurement of radio-iodine in the thyroid gland. *Brit. J. Radiol.*, Dec., 1949, *22*, 698–705.

Three methods of measuring the amount of radioactive iodine in the thyroid gland are: the removal of tissue with quantitative radioactive assay; the removal of tissue with qualitative study by radioautography and paper chromatography; and external gamma-ray measurements.

The authors describe a Geiger counter with standardized specifications and a highly directional probe unit. This is used to measure the radioactivity in patients' thyroid glands under specific and reproducible conditions of distance and direction. These conditions were reproduced for measurement of known samples in three different phantoms and formulae were worked out for quantitative estimation of the amount of iodine present.

This method has been applied to 13 patients and reasonable accuracy obtained. Any error can be substantially reduced by correlation with the urinary excretion of iodine.—*E. F. Lang, M.D.*

Nachman, Herman M., Crawford, Vernon, and Bigger, I. A. Radioactive iodine (I^{131}) in the diagnosis of lingual thryoid. *J.A.M.A.*, Aug. 6, 1949, *140*, 1154–1156.

This article illustrates the value of radioactive iodine tracer techniques in the surgical management of thyroid abnormalities. A case report follows:

A white girl, ten years of age, was first seen August 2, 1948, complaining of a lump in the tongue. The child's speech was somewhat impaired and there was slight difficulty in swallowing. The pertinent physical finding was that of an oval red mass measuring 3 by 2 by 2 cm. at the base of the tongue at the site of the foramen cecum. The thyroid gland was not palpable in the normal position.

A tentative diagnosis of lingual thyroid was made and surgical removal was advised. Although no thyroid gland was palpable in the neck, it was important to determine whether the lingual mass contained all of the functioning thyroid tissue. This could have been solved by surgical exploration of the thyroid area, but this proved unnecessary following the use of radioactive iodine. A tracer dose of 10 microcuries of radioactive iodine (I^{131}) obtained from Oak Ridge was given orally. A Geiger-Müller tube enclosed in a lead container to columnate the gamma rays given off by I^{131} was used to determine the localization of this material in the lingual thyroid and in the thyroid area in the neck. The concentration of I^{131} (expressed as counts per minute) is diagrammatically il lustrated in the article.

On the basis of these results, it was concluded that the mass at the base of the tongue was functioning thyroid tissue and that the patient had little, if any, functioning thyroid tissue in the normal location.

A subtotal resection of the mass in the tongue was performed.

The presence of a lingual thyroid is proved by radioautograph and later by microscopic examination.—*R. F. Niehaus, M.D.*

Layton, Laurence L. Labeled inorganic sulfate in the diagnosis of cartilaginous tumors and their metastases. *Cancer*, Nov., 1949, 2, 1089–1092.

An investigation of the differential fixation of inorganic sulfate labeled with radioactive sulfur in cartilaginous tumors, their metastases, and normal tissues was carried out as a possible diagnostic test for such tumors which may be difficult to confirm by classical methods. Biopsy samples of tissues were taken from the center of tumors, the periphery, and neighboring normal tissue. Various fragments were incubated in Tyrode's solution to which had been added sodium sulfate labeled with radioactive sulfur S^{35}. Tissue cultures were chemically processed, dried, and counted with a Geiger-Müller tube after correction for background and self absorption to 30 mg. $BaSO_4$.

The results of six preliminary experiments in which adult human tissues were maintained in tissue culture show that human normal and tumor tissues exhibit characteristic differential affinities for sulfate similar to normal tissues of the intact rat and embryonic chick. The differential sulfate fixation in each case showed the presence or absence of cartilaginous tissue and thereby served as a rapid confirmatory test for cartilaginous cancers and their metastases. Sulfate is retained chiefly in the bone marrow, bone, and cartilage. The test seems of value to detect possible cartilaginous tissue in tumors not clearly classified by histologic means.—*J. A. Campbell, M.D.*

Wainwright, William W. Detail and survey radioautography. *Science*, June 10, 1949, *109*, 585–587.

The technique of contact radioautography of tissue which has received radioactive isotopes is now well known and widely practiced. Recently a method has been developed which is called "detail radioautography" which utilizes a specially prepared film containing a so-called "nuclear track" emulsion. This emulsion records the effect of nuclear particles which strike silver particles in the emulsion during their path of travel from origin to absorption. By tracing back the path of the particle as demonstrated by the changes in the photographic film one can positively identify the source of origin of the particle and hence the distribution of the radioactive isotope atoms.

Because of the difficulty in correlating the ordinary contact radioautograph with the histologic section of tissue from which it is obtained, this new method should add a great deal to the accuracy of determining the distribution of radioactive material in tissues upon a microscopic level.—*R. P. Barden, M.D.*

MISCELLANEOUS

Wener, J., Hoff, H. E., and Simon, M. S. Production of gastric and duodenal ulcers by the prolonged administration of mecholyl. *Gastroenterology*, Dec., 1948, *11*, 904–922.

It has been shown that hemorrhage, erosions and acute and subacute gastric or duodenal ulcers can be produced in dogs by the prolonged daily administration of mecholyl. Vascular stasis, altered capillary permeability, hemorrhage, tissue anoxia and necrosis of mucosa are suggested as the sequence of events in the pathogenesis of these lesions and additional factors such as trauma, acidity and nutritional state have been discussed. These experiments reinforce the vascular concept of peptic ulcer formation.—*F. J. Lust, M.D.*

Donovan, G. E. Some aspects of radiology in war-time Germany. *Brit. J. Radiol.*, June, 1948, *21*, 305–308.

This report is based on the results of investigation of Allied teams which entered Germany close after the Allied Forces. The trends in German radiology during the war period when an iron curtain existed between that country and the Western Powers were toward the development of automatic methods, compensating devices, safety measures and foolproof apparatus.

Two types of roentgen stereo-fluoroscopy, one by Siemens-Reiniger and one by Wiegelmann, were introduced both of which gave good results. A method of photoroentgenography is described in detail. Developments in the use of a roentgen-ray constant potential generator, an automatic timing device and roentgen protective measures are also discussed in detail.

It is concluded that the war did not contribute significantly to German radiology.—*K. L. Krabbenhoft, M.D.*

Newbery, G. R. The microwave linear electron accelerator. *Brit. J. Radiol.*. Aug., 1949, *22*, 473–486.

The first linear electron accelerator was described in 1929, but because of the limitation of the frequencies available at that time, acceleration of lighter electrons was more practical with the cyclotron. Recent development of microwave techniques has reopened the field by making possible relatively small machines which will not be limited by the inherent radiation losses associated with circular orbit machines. Medical interest is in the possibility of having a small, silent, high intensity source of roentgen rays for therapy.

A detailed discussion of the operation and limitations of the traveling wave accelerator, the standing wave type, and the multiple cavity type is given.

It is estimated that linear electron accelerators will be useful in medicine in the range between 3 and 20 mev. Below that range conventional high voltage generators are suitable, and above it synchrotrons and betatrons will probably have a high enough roentgen-ray intensity.

Some of the problems in mounting such a machine for clinical use are discussed.—*E. F. Lang, M.D.*

Mabbs, D. V. An experimental study of back scatter with x-ray beams of small area. *Brit. J. Radiol.*, Oct., 1949, *22*, 600–604.

Measurements of backscatter for fields of diameter between 2 and 10 cm. for radiations with half-value layer between 0.06 to 1.40 mm. of copper. Measurements were made in Columbia paste and in water using a "micro" condensing ionization chamber.

Discrepancies between the results obtained and previously published figures are explained on the basis of variations in the type of phantom material and also by the errors introduced by the stem of a larger ionization chamber than the one used for the present experiment.—*E. F. Lang, M.D.*

Cowing, Russell F., and Spalding, Charles K. A survey of scattered radiation from fluoroscopic units in fifteen institutions. *Radiology*, Oct., 1949, *53*, 569–574.

The authors, using a beta-gamma survey meter measuring in milliroentgens per hour, measured the scattered radiation originating from: (1) the under side of the table top, (2) the patient, (3) the fluoroscopic screen, (4) the walls adjacent to the fluoroscopic unit, and (5) the floor (impinging on the examiner's or assistant's legs) during an actual fluoroscopic procedure. Measurements were carried out with 13 tilting fluoroscopes in the horizontal position, 9 in the vertical position, and 3 upright fluoroscopes.

The conclusions to be drawn from this study are: (1) there are still roentgenoscopic machines in use that are probably unsafe (two of the units tested permitted only 4 and 7 examinations to approach tolerance); (2) the ordinarily used lead rubber apron can be improved—by better coverage, or by the adoption of the lead glass woven gown as suggested by Dr. V. W. Archer and associates; (3) more adequate protection, by lead gown, apron or barrier should be afforded assistants; (4) the minimum room size should be 12 by 14 ft. with the walls 6 ft. from the roentgenologist in any examining position; (5) 1 mm. aluminum filter may be added to the fluoroscopic tube with decrease in scatter and without decrease in screen brilliance or detail.—*S. H. Fisher, M.D.*

Mudd, Stuart. Electron microscopy in relation to the medical sciences. *Ann. Int. Med.*, Oct., 1949, *31*, 570–581.

The electron microscope is a modern device for obtaining optical images of objects particularly of submicroscopic dimensions. Illumination is by a beam of electrons focused by a system of electromagnetic lenses analogous to the glass lenses of a microscope. Accurate imaging of details of pattern down to about 0.2μ are obtainable with the light microscope. Under appropriate conditions the electron microscope is currently giving accurate pictures of fine structure down to 0.01μ diameter. In organic material dense particles of 0.002μ diameter can be resolved.

Because of the newness of electron microscopy, the high cost of the instrument and the expertness required for proper maintenance, operation and interpretation, the electron microscope is certainly not now, nor is it likely to become soon, an office instrument. A beginning has been made, however, in application of electron microscopy to the differentiation of certain related viruses. Such uses and the newly developing techniques of preparing tissue sections will probably soon give electron microscopy places of application in diagnostic laboratories in the larger hospitals and institutes. The prospect which is most exhilarating, however, is that of pure scientific research, the exploration of one, possibly two new orders of magnitude of fine dimensions by electron microscopy supplementing other current research instruments and techniques.—*E. J. McDonald, M.D.*